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JANUARY 1959

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NEXT ISSUE

Our February issue will carry a comprehensive article on aerosol coatings. Important factors such as formulation, propellent and compatibility considerations, and viscosity will be featured, as well as mechanical problems on value design, pressure, and packaging methods.

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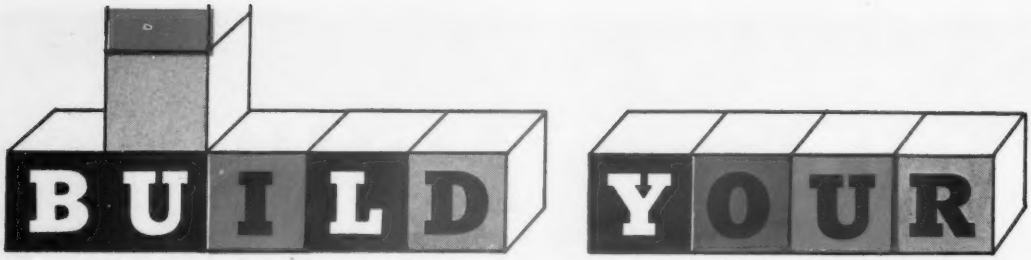

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EDITORIAL COMMENT

Mild Optimism

THE last quarter of 1958 was characterized by a moderate upswing in business activity which is expected to carry over into 1959. During this period, production, construction, and retail sales registered a general improvement over the third quarter. While over-all production of durable goods has shown a steady growth, the durable goods index is still 12 percent below its previous peak due to the sharp drop in durable good production at the outset of the recession. Some lines such as machinery and transportation have shown only minor gains.

The whole key to economic recovery depends on business and consumer demands of durable goods.

Business spending for new plant and equipment is expected to rise slowly during 1959. Estimates are that capital spending will be at an annual rate of $30.5 billion for the first quarter and further increases are contingent on profit trends.

Cautious buying will dominate consumer spending in 1959. Despite the general improvement in employment conditions, the recent levelling of employment has caused some hesitancy among consumers toward major purchases. According to the December letter on Business and Economic Conditions issued by the First National City Bank of New York, non-agricultural employment moved up only one percent in the first six months of the recovery and while unemployment reached a 1958 low in October of 3.8 million persons, it is still a problem in many areas. In addition, losses arising from strikes temporarily halted the rise in personal incomes. Thus, consumer spending for durable goods will be influenced largely in the speed of recovery in incomes and employment.

One of the strong features affecting our nation's economy in 1959 is the construction picture. According to the F. W. Dodge Corporation, construction in 1959 will set records totalling $35.6 billion, a three percent rise over the 1958 estimated total of $34.7 billion.

New factory buildings will represent the largest increase—some 14 percent. Public and private housing starts should go beyond the million mark and equal the 1958 level. One adverse effect on this segment of the construction picture is the rising interest rates on Veterans Administration and Federal Housing Administration mortgages. Heavy contracts which include highways are expected to reach $9.7 billion, up two percent from 1958.

By contrast, the Commerce and Labor Departments are more optimistic in their estimate of construction for 1959. They predict total construction to run as high as $52.3 billion with private construction accounting for $35.2 billion and public construction accounting for $17.1 billion.

Government spending will increase by at least $8 billion. States and local municipalities will earmark $3 billion for schools, waterways, etc. while Federal outlays for defense, farm aid, and highways will reach $5 billion.

Another important factor in the economic outlook is the improved condition of the automotive industry. Automotive production in December hit a total of 593,778 passenger cars, which was the highest monthly total for 1958. While total production for 1958 was only 4,244,005, lowest in 10 years, output for the last two months showed a decided upward trend. Most dealers report brisk sales and are convinced that the public is pleased with the 1959 models, but because of shortages they claim sales could be even better. However, it will take at least another month, when inventories are expected to be normal, to ascertain the trend in car sales. One automobile executive is forecasting a sales volume of 5.5 million cars for 1959.

In sizing up the economic climate for 1959, the general feeling is one of mild optimism.

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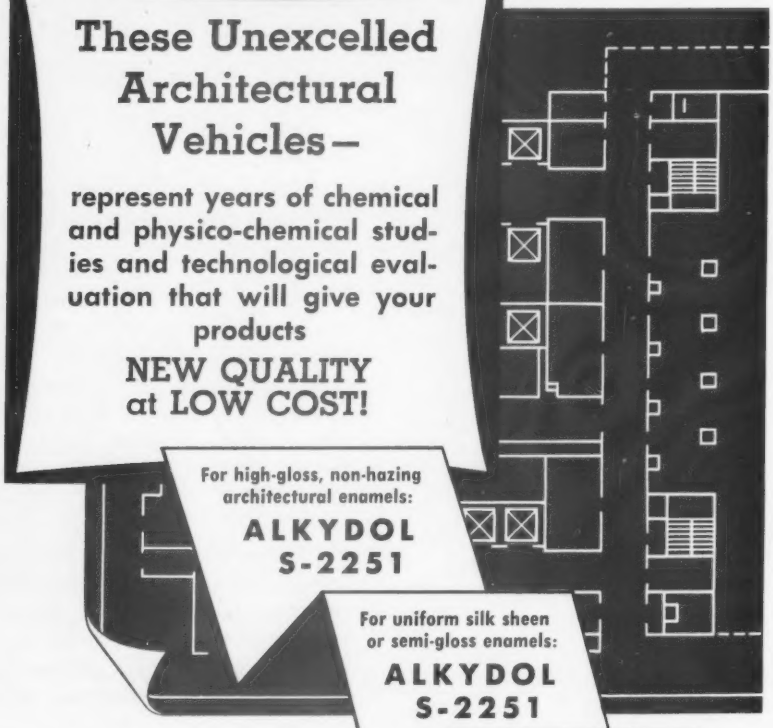

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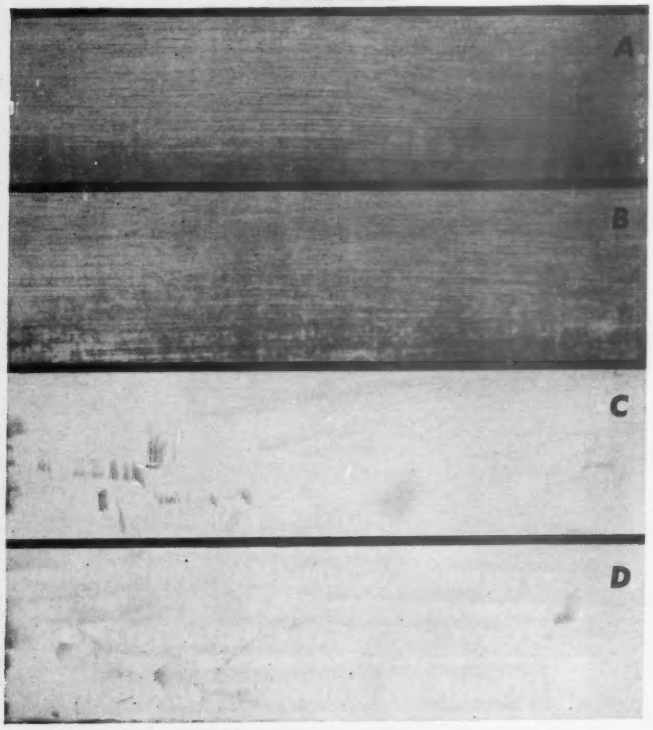

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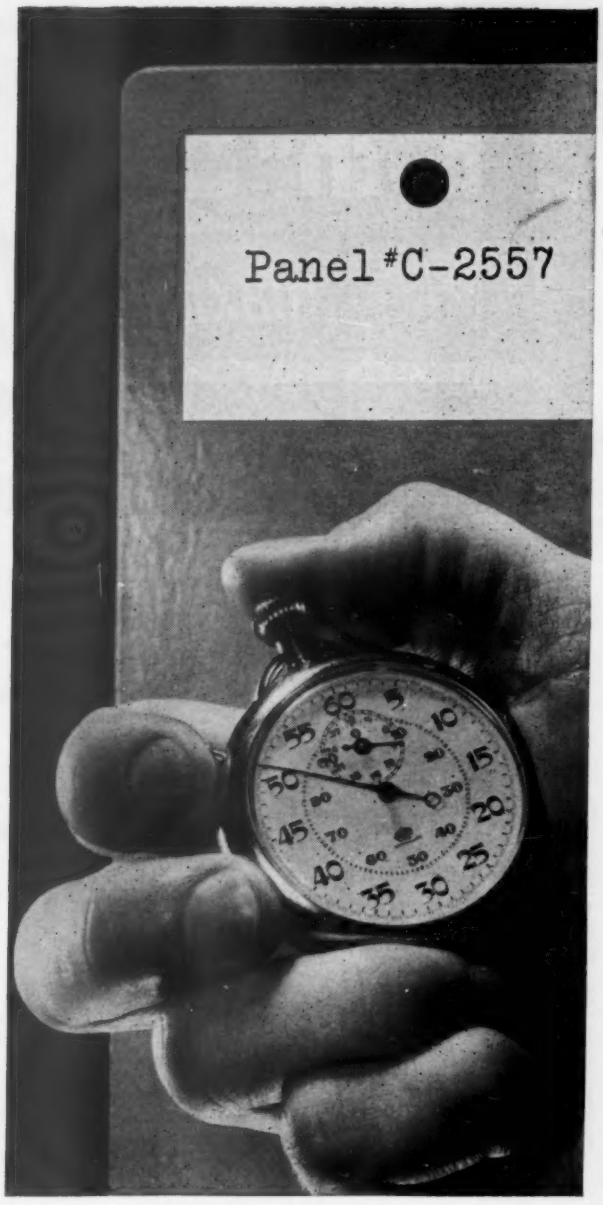

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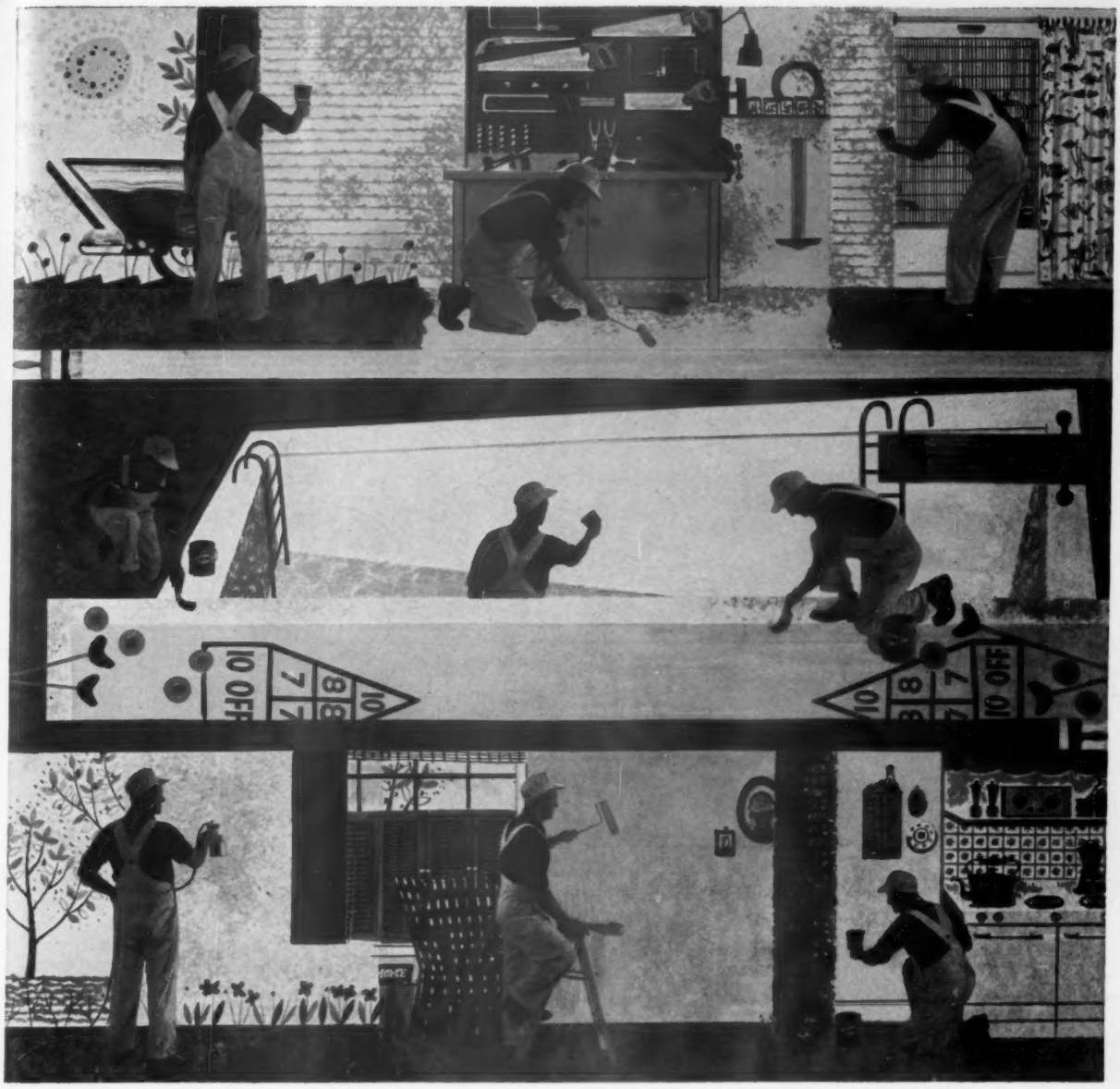

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OUTLOOK for 1959

Record Paint Sales Expected with Resurgence of Industrial Activity and Continued Rise in Construction

By
ANTHONY ERRICO
Editor

IN 1957 the paint industry did a sales volume of $1.6 billion. Although figures for 1958 are incomplete, there is every reason to believe that total paint sales for last year should equal the 1957 volume, which was a record year. Figures available for the first ten months of 1958 show trade sales to be up 6% and at this rate 1958 could top the $1 billion mark. Cutbacks in auto production earlier in 1958 hurt industrial sales, but with auto production moving at a faster pace during the latter part of the year, the gap between 1957 and 1958 industrial sales should narrow somewhat. However, most experts agree that industrial sales for 1958 will be less than $600 million. 1957's total industrial sales reached $644 million.

The paint industry looks for greater sales in 1959. This optimism stems from (1) the healthy outlook for business in 1959, (2) record construction expected in 1959, and (3) higher production of automobiles during 1959. One important factor in the long term outlook is that our population is growing at an explosive rate. This means more homes, more furniture, more automobiles, more appliances—more of everything.

Like any other industry, the paint industry cannot grow without technological progress. With the demands of both industry and consumer becoming more and more critical, the paint industry must turn to technology for developing new products. Failure to meet this demand would only increase interest and use in protective and decorative materials other than paint.

1958 was a year of considerable technological activity in the coatings industry. A discussion of the important developments that have taken place in paint raw materials is presented in this feature. An attempt is also made to forecast what effect these developments will have on the technology of the paint industry during 1959.

Intermediates

Potential capacity of phthalic anhydride is moving up with Reichhold slated to produce some 30 million pounds a year at its new five-million dollar unit in Elizabeth, New Jersey sometime during the latter part of 1959. New production facilities of both Witco and Amoco will add another 80 million pounds to the total output of phthalic anhydride. By 1960 total

domestic capacity for phthalic anhydride together with isophthalic and other isomers should reach some 600 million pounds.

The key to adequate production of phthalic anhydride lies in the supply of naphthalene, particularly from domestic coal tar. Phthalic anhydride represents the major use of naphthalene and consumes about 80% of its annual supply.

In recent months there has been some concern about whether or not naphthalene supplies will be able to keep pace with the expanding phthalic anhydride market. According to Dr. James N. Roche, of the Koopers Company's Tar Products Division, part of this difficulty lies with the unusually large percentage of the product devoted to this single use, for sudden increases in demand for phthalic sometimes find ready supplies of naphthalene lacking. Faced with such deficiencies of supply, naphthalene producers rush to catch up and this naturally causes overproduction. The practice of scheduling production of only enough napthalene to meet normal demand stems from industry's knowledge that naphthalene is abundantly present in tar and because it is so available, it has become the custom to avoid large inventories of this giant among coal tar chemicals. The question is then—how much naphthalene is available in coke oven tar supplies to meet increased demands?

In 1957 some 340 million pounds of phthalic were produced. Naphthalene production was around 415 million pounds, but actually 600 million pounds were available through imports and inventory from 1956 capacity.

The future supply picture for naphthalene is bright as continued expansion of steel mill capacity will mean more coke oven tar production for additional naphthalene recovery. By 1965, Roche contends, some 980 million pounds of naphthalene will be produced in the U. S. Add to this amount another 79 million pounds of imported naphthalene, the total supply of this important coal tar chemical will be 1059 million pounds. This quantity could produce in 1965 (after deducting 120 million pounds for refined naphthalene) 740 million pounds of phthalic anhydride. This, according to Roche compares favorably with the 460 million pounds of phthalic which will be required for that year.

Phthalic anhydride continues to find its largest outlet in alkyd resins. New types of alkyds are emerging from research laboratories every day. Of particular importance are those modified with 25-30% melamine now appearing in the finishes on several well known makes of automobiles. Such resins impart high gloss, color retention and weatherability.

Under development also are new phthalic alkyd-acrylic polymers designed mainly for industrial finishes. Films using such resins are based on single coat systems and are characterized by toughness, excellent water resistance and adhesion. They are of particular value for venetian blinds and appliances and show promise for exterior applications where durability is required.

Epoxy-alkyds, of course, are becoming well known for their chemical resistance. This, combined with their adhesion and toughness, has led to their use in metal primers and in maintenance finishes.

Research is continuing on alkyd resin emulsions, and a major breakthrough could well occur in 1959. Once this has happened, an entirely new field will be opened to alkyd resins—that of water emulsion vehicles. The growth of latex water based paints has been phenomenal. Over the years, they have taken a substantial share of the market long held almost entirely by alkyds—that of flat wall paints.

Additional research involves the modification of alkyds by the incorporation of alpha methyl styrene or vinyltoluene. This produces resins which are of interest in interior coatings because of rapid drying time—two to five minutes.

In the field of polyols both glycerine and pentaerythritol are expected to be in adequate supply to meet the requirements of alkyd producers.

It has been estimated that some 70 million pounds of glycerine went into alkyd resin production during 1958. 1959's consumption is expected to remain at the same level. Total output of crude glycerine dropped from 238 million pounds in 1957 to about 200 million pounds in 1958 while stocks of refined dropped from 55 million pounds to slightly under 40 million pounds. However, supply of glycerine should be no problem in future years with more synthetic glycerine becoming available. Shell Chemical is constructing a new glycerine unit at Norco, La., rated at 35 million pounds per year.

The demand for glycerine for use in alkyd resins will remain dependent upon the technological race for improved paint vehicles, as well as the general business curve. Glycerine producers feel that competition between polyols is secondary to market factors affecting alkyds as a class. However for 1959, it appears that alkyd resins in new modifications and combinations will have found ways to hold their substantial place in industrial finishes. Producers of glycerine are basing their plans on the expectation of technical advances within the alkyd field that will disprove predictions of their obsolescence.

Like glycerine, the major uses of PE (pentaerythritol) continues to be in alkyd resins. Other uses of PE are in rosin esters and synthetic drying oils. Technical PE accounts for 80% of all the PE used; mono-PE about 17%; and the remaining 3% in the form of di- and tri-PE. Annual production of PE in the U. S. is about 130 million pounds. Some 50-60 million pounds of PE went into synthetic resins and drying oils during 1958, which was about the same amount used in 1957.

Undoubtedly technology has immeasureably helped PE to maintain its position in the synthetic resin field. For example, improvements in the quality and availability of tall oil fatty acids at attractive money value prices made this fatty acid an important modifier of long oil oxidizing alkyds plus its use in baking type alkyds. Investigations have shown that PE works particularly well with this slow drying acid in alkyd formulations to achieve optimum drying properties. Another factor con-

tributing to PE consumption is its continued use in PE-soya-phthalic alkyds. Of considerable interest was the announcement by one paint manufacturer last year that he would convert his exterior house paint line from oil to alkyd vehicles. PE-isophthalic and orthophthalic long oil alkyds as exterior paint vehicles have been under test for a number of years, as well as long oil alkyds made with other types of polyols.

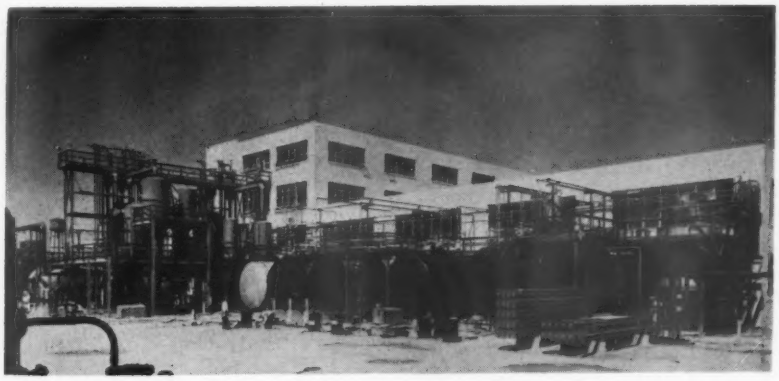
Another interesting development has been the use of PE and glycol as coesterifying polyols in the manufacture of long oil oxidizing and short oil non-drying alkyds. The good heat, light and moisture resistance of PE-glycol non-drying alkyds for baked alkyd-amine finishes is exemplified by PE non-drying alkyd made of pelargonic and caprylic acids as a monabasic modifiers in high amine content alkyd-amine baked enamels. In this discussion, mention must be made of the steady use of PE in rosin esters. During 1958 the use of rosin esters in the paint industry held about 90% of the 1957 level.

Current demands of PE is about 60 million pounds. Since existing facilities are capable of producing 100-130 pounds per year, it is quite possible that this current level of demand has placed some of the installed capacity on a stand-by basis. Obviously there is ample PE capacity to take care of any needs over the immediate future.

Amoco's trimellitic anhydride for synthesizing water-soluble alkyds created quite a hit at the Paint Show in Cleveland last October. Available in development quantities, Amoco is also offering this intermediate for application in baking finishes. Good adhesion, flexibility and gloss are claimed of the trimellitic-based paints.

Other important developments in intermediate chemicals are utilization of trimethylolethane and trimethylolpropane in alkyd vehicle synthesis to impart improved heat stability, improved gloss and color retention, alkali and detergent resistance, and better exposure resistance and weatherability.

A resinous polyol was introduced to the coatings field by Shell Chemical last year for preparing simple esters of fatty acids which provide vehicles with such film properties as high gloss, good alkali resistance, good gloss retention upon weathering, good water resistance and good color retention in ultra-violet exposure.



Heyden-Newport's pentaerythritol plant, Fords, N. J. which opened in early 1958 uses automated equipment in producing this intermediate.

Drying Oils and Derivatives

The general supply outlook for all drying oils is good. In fact, we now have a world surplus of fats and oils, which according to the experts, will be with us for sometime.

Of the total amount of drying oils consumed in the United States, linseed accounts for about 45% and soybean, the largest gainer about 25%. Tall oil is moving along and now accounts for a little over 10% of the total.

It is estimated that crude tall oil production in 1958 would total some 300,000 tons. Based on the skimmings available from Southern kraft paper mills, the potential could be about 470,000 tons. By 1960 this potential is expected to reach 500,000 tons and by 1975, 900,000 tons. Another interesting aspect of tall oil production is the increase in fractionating capacity with two new plants coming on stream in 1958—Glidden and Monsanto-Emery. Total production of fractionated tall oil for 1958 is estimated to be 319,000 tons and tall oil fatty acids 100 million pounds. Based on capacity, production in 1959 could be nearly 150 million pounds. Distilled tall oil production was estimated at 135 million pounds last year.

Safflower oil has found increasing use as a raw material to paint and resin producers. One reason for this increase has been the predictable steady price of this drying oil. According to Pacific Vegetable Oil Corp., this situation has been particularly striking during 1958 when for many months during the summer and fall soybean oil has been in over supply and averaging in price at some delivery locations as much as 3 or 4 cents per pound below the delivered price of equivalent refined grades of safflower oil. At many locations price of linseed oil also has been lower than safflower and yet volume of safflower oil movement to consumers during the crop year which began September 1, 1958 has been at a much rapid pace than ever experienced before.

Progress in drying oil technology was also noted in 1958. Most of this progress was concerned with modifying drying oils through various routes. Of particular interest were vinyltoluene-modified oils and the diisocyanate-modified oils.

Vinyltoluene and the oil may be copolymerized either by the solvent method or at "100% solids" in a solvent-free system. Low cost, quick drying enamel vehicles are possible with vinyltoluene modification of drying oils. With vinyltoluene modified oils of longer length, a low cost architectural flat vehicle can be produced.

By modification with diisocyanate, a urethane oil is produced. The properties of urethane oils will vary considerably depending upon the extent of modification with diisocyanate. Generally, urethane oils as compared to ordinary drying oils have greater hardness, higher gloss, good abrasion resistance, improved water-resistance, better resistance to acids, alkalies, and solvents and greater film strength. However, urethanes as a whole

tend to yellow, especially those containing a high proportion of isocyante. In some cases, two-can systems are necessary for satisfactory shelf-life, especially for those products offering the greatest chemical resistance but are difficult to pigment.

A promising development from chemurgy published during 1958 has been coatings based on vinyl ether copolymers of fatty alcohols converted from soybean and linseed oils. Research conducted by H. M. Teeter, L. E. Gast, and J. Cowan at the Northern Utilization Research and Development Division, USDA in Peoria, indicate that these coatings show promise in the metal (particularly cans) field because of their unusual adhesion to metals including black iron and aluminum. Also, they have superior resistance to water, alkali, and acid. According to Teeter, other important applications of this film-former, in addition to replacing tin on cans, include interior can linings, can and drum exterior decorative coatings, appliance finishes, maintenance paints, and primers for concrete and masonry.

The development of fire-retardant coatings from isano oil was an important achievement in drying oil technology last year. Isano oil is an unusual type of vegetable oil; its fatty acids have conjugated acetylenic bonds, a terminal ethlenic bond, and an hydroxyl group. When isano oil undergoes certain heat treatment, exothermic reaction takes place with the evolution of heavy white fumes. This property led to the use of isano oil as an intumescent vehicle in fire-resistant coatings. When a surface coated with a paint which contains raw isano oil and a drying oil is exposed to sufficient heat, the exothermic reaction set off causes the film to swell by the evolution of gases, thus providing a protective insulating layer.

Other important developments include ethoxylating cator oil or its derivatives to make them water dispersible or miscible for possible application in emulsion systems as stabilizers, levelling agents and antifoaming agents. The improvment in the quality of tall oil fatty acids, especially in color, through a new vacuum fractionation process was also developed last year.

Synthetic Resins

Acrylics

Probably the most important technological development in the field of acrylic resin solutions has been the adoption by the General Motor Corporation of all acrylic finishes for its cars. G-M is calling them "Magic Mirror" Finishes and has used this term extensively in their advertising and promotion campaign during the past year.

General Motors claims that these finishes have much longer gloss retention on outdoor exposure (requiring less polishing) and are more resistant to road tar. They also claim that the acrylic finish adds new richness in colors and that acrylic type pearl essence takes on new depth and profusion of shades.

An important aspect of the acrylic finish is its effect on the refinishing of automobiles. Acrylic refinishing materials must be used on an acrylic coated car, and lacquer or enamel type are recommended on non-acrylic finished automobiles.

At present acrylic resin are in moderately good supply. Rohm & Haas reports brisk activity in recent months due to the change over to acrylic finishes by General Motors. Basic polymer capacity is adequate for all foreseeable needs in the next two or three years.

Alkyds

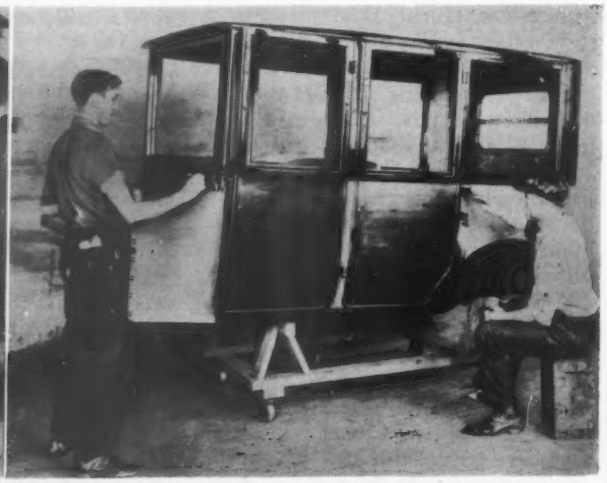
Consumption of alkyd resins for protective coatings has dropped over the past three years. In 1957 the paint industry used some 435 million pounds of alkyd resin, compared with 1955's high of 491 million pounds.

This drop in alkyd usage can be attributed to the steadily increase in the use of latex emulsion paints. With latex emulsion paint accounting for 13% of the total surface-coating market, alkyd suppliers are currently engaged in intensive research to develop new forms of alkyds to regain their position lost to latex emulsion paints.

One facet of this research program is to develop water emulsion alkyds for both trade sales and industrial application. Both American Cyanamid and Reichhold have marketed alkyd emulsions for interior paints.

In the industrial field, especially for automobile primers, alkyd man-

Acrylic lacquer being applied to 1959 General Motors cars. Process requires 4½ hours per body.



In the early twenties varnish was applied to auto bodies with a brush. Process took 30 days.

ufacturers have come up with emulsions which have some interesting properties. These alkyd emulsions are said to bake well, forming an insoluble film with high adhesion to the substrate, acting as a primer sealer under all types of top coats. After baking, these alkyds form a tri-dimensional film which is definitely less thermoplastic and often tougher than conventional latices. A ramification of this development is that because of their initial lower molecular weight, these emulsion alkyds are being evaluated for outside durability over chalky surfaces. Since the alkyd particles are more easily deformed and have a high degree of polarity, they can slip between the loose, chalky particles, bind them, and adhere to the surface beneath this chalky dust.

The polyester field has caught the attention of some alkyd manufacturers, and, in recent months, unsaturated polyesters have entered the protective coating field in various forms such as 100% solid resins, solutions in organic solvents, or water dispersions and solutions. While the work done on these resins goes back many years, some interesting finishes have been developed from these resins which compare favorably with the famous Chinese lacquer work. Of equal importance have been saturated polyester alkyds (epoxy modified) which possess some outstanding properties in industrial application such as good color and gloss retention, non-yellowing, especially on overbakes, and exceptionally clean colors. High raw material costs handicap the use of these resin on a large scale. In this field extensive development work is being carried out with the aid of new polyols and monobasic acids.

Flat alkyd paints employing low odor solvents have maintained their popularity with the professional painter and are still selling at a good volume. Claims made for flat vehicles containing high percentages of phthalic are excellent scrubbability and maximum in color and sheen uniformity with no ghosting. It is interesting to note that flat alkyd paints are being evaluated for outside work. They are formulated with lower pigment volume concentration.

Non-drip paints that require no mixing and won't spill or splatter are examples of thixotropic paints. Paint changes from gel to liquid upon brushing, rolling or stirring action.

For high quality industrial finishes as well as for high grade shelf goods and white enamels, the common triglycerides of vegetable oils are not satisfactory any longer and are being replaced with fatty acids free of linolenic acid and low in oleic and stearic and palmitic acids, at least as far as non-yellowing air drying and baking finishes are concerned. Numerous fractionated fatty acids are offered for this purpose, but their high price restricts their use. The introduction of low rosin content tall oil fatty acid has filled the gap here, and fairly high grade products, at least for baking finishes, can be produced using these fatty acids.

Long oil soy alkyds are still the most important vehicle for producing high grade enamels for inside and outside use. Properly formulated, these enamels have excellent color retention and durability. For best color retention on the interior, it has been found that a small percentage of zinc oxide, (preferably colloidal zinc oxide) will do the trick. If the enamel is to be used outdoors (trim, trellis, lawn furniture) it is best to leave the zinc oxide out to avoid embrittlement of the film.

Thixotropic Vehicles

Thixotropic vehicles are providing paint formulators with another ingredient for use in many types of solvent paints. According to T. F. Washburn, thixotropic vehicles are used as a modifier of present vehicle formulation, or as a major or sole replacement of this conventional vehicle. This modification is designed to make the paint easier to use and to apply. Thixotropic vehicles are finding use in industrial finishes, in printing inks and in other applications where new and better properties are demanded of conventional materials.

Alkyd vehicles may be gelled with Phelate 77, an aluminum compound produced by J. S. Ayers & Company. This compound has the property of cross-linking poly-

mers containing hydroxyl groups. Such gelied alkyd can contribute thixotropic structure to coating compositions.

Recently, Dewey & Almy offered a formulation for white gelled paint based on Everflex GT, vinyl acetate copolymer. The thixotropic paint has a gelled consistency in the can but flows smoothly onto surfaces in a coat scarcely thicker than a conventional latex paint.

Cellulosics

A recent extensive survey of the furniture industry showed that 80 per cent of the wood furniture now being manufactured in the U. S. is finished with nitrocellulose lacquer. A similar survey ten years ago indicated that 76 per cent of the furniture was finished with lacquer, so lacquer has at least held its position. Consumer purchases of furniture have shown an average annual rate of growth (in terms of 1947 dollar) during the post World War years of 2.2 percent. Although this is not a startling rate of increase percentagewise, a few percent on a large industry such as the furniture industry represents a considerable volume. It would appear that nitrocellulose lacquers would continue to hold their position in this field, and that the coming year will show an increase in the buying of furniture. Plans to further stimulate interest in buying new furniture with particular emphasis on finishes are being formulated. The expected continued high rate of building new homes will also provide new markets for lacquer because of the trends toward built-in lacquered cabinets and lacquered floors.

A rapidly growing market for nitrocellulose is in multi-color lacquers for exteriors and interiors of new schools, homes, hotels and motels, municipal and office buildings, and industrial plants. Requiring only normal techniques and equipment, multi-color lacquer finishes permit the simultaneous spraying of two or more colors as a single finishing coat. A continued boom in building will provide expanding markets for nitrocellulose-based multi-color lacquers.

In the automotive field, nitrocellulose lost 7-8 million pounds to the acrylics last year. However, nitrocellulose lacquer for refinishing automobiles is expected to maintain its position at least for the next five years.

In the way of recent technology, DuPont's Explosive Department has developed an epoxy modified nitrocellulose lacquer which is resistant to ultraviolet light, has excellent adhesion, flexibility, and hardness, and resists a wide range of solvent and chemicals.

Another development which merits mention is the use of sucrose acetate isobutyrate (SAIB) in nitrocellulose lacquers. SAIB is a sugar derivative produced by Eastman Chemical Products. Incorporated into coating formulations its behavior is intermediate between a resin and plasticizer. In lacquers, SAIB, because of its low solution viscosity, permits higher non-volatile content without exceeding application viscosities. Film hardness does not decrease with SAIB modification, and improvement in adhesion have been claimed.

Epoxy Resins

The consumption of epoxy resins has been increasing steadily. Production output for epoxies in 1957 was 40 million pounds. Plant capacity for the production of epoxies will expand with the completion of Ciba's new plant at Toms River, N. J. early this year.

Epoxy resins are assuming a more important part of the formulators time and effort. This is due largely to the greater availability of detailed technical data, as well as information and experience resulting from case histories where epoxies have proven to excel in particular fields. The outstanding properties imparted to finishes and compounds in which epoxy resins are used are adhesion, alkali-resistance and chemical resistance. The properties are important in industrial finishes. In the trade-sales field, epoxies formulated into esters are providing coatings for floor (wood and concrete) and marine use.

Trowelling epoxy flooring compounds.

Another field in which epoxy resins have made their mark is in waterproof finishes on masonry. This has led to a wider use for the decoration and protection of building materials such as cinder block, concrete, etc.

Epoxy resins have had considerable success in flooring compounds. In new construction, a veneer-type topping, based on epoxy resins with a sand aggregate over thinner concrete floors, not only saves considerable weight in total structure and money in steel required to support this weight, but also provides a durable surface which is four times stronger than concrete itself. At the same time, other important, properties of alkali-resistance are attained.

Another area in which these compounds may fit is on roads and highways. Epoxies provide durability as well as safety, since they can be formulated with a high-friction surface to give audible warning to the motorist. This field alone represents an enormous market for epoxies.

Forecasts for the next ten years indicate a 50% increase in new construction expenditures, and highway construction will increase some 88% by 1967. With the important place that epoxy resins already occupy in the coatings field, their growth for all present uses is assured. In addition, new uses will continue to take advantage of the unusual properties of these resins. For example, in certain application the upgrading of alkyds by the addition of epoxies is desirable.

Union Carbide recently announced a new way of preparing diepoxides. Epoxide-201, dicyclopentadiene dioxide and vinylcyclohexene dioxide are examples of this new form of epoxies. The diepoxides will react with anhy-

drides to produce epoxy materials for various applications. Currently 95% of epoxy resins are made of epichlorohydrin and bisphenol A. Diepoxides with a variety of molecular weight from 358 to about 9,000 are available. The liquid resins have molecular weight below 1,000 and are used for laminates, castings, and electrical encapsulation. The highest molecular weight solid resins are used for making fatty acid modified and other types of coatings. Carbide claims that the fast reactivity of Epoxide-201 makes possible the use of just one product for coatings as well as the conventional liquid resin applications.

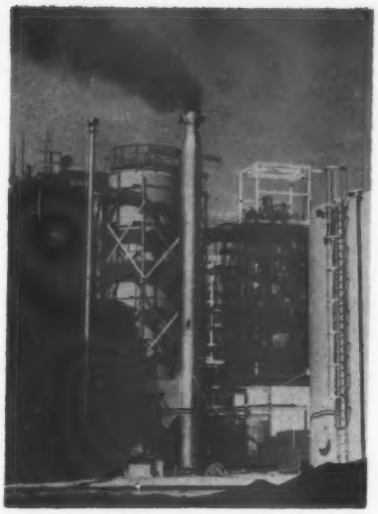
Silicones

As a result of the expanding number of commercial and military applications requiring high-temperature protective coatings, the demand for silicone resins and additives is expected to increase in 1959. Typical applications for high-temperature paints include boiler and exhaust stacks, mufflers, furnace and oven exteriors, high temperature processing equipment, exhaust manifolds and jet engine components.

Extensive research and product development has taken place in the silicone field during the last 12 months.

Dow Corning has done some interesting work with a reactive silicone intermediate to prepare silicone-alkyds and silicone-epoxy resins. Dow Corning describes this intermediate as a high phenyl content, reactive silicone resin of the siloxanol type.

A more recent development by Dow Corning has been a process for making epoxy resins with a silicone backbone. This new family of resins are called epoxy organosiloxanes which are stable liquids with lower viscosity than comparable derivatives of phenols or alcohols. Possible coating applications predicted by Dow Corning for the epoxy organosiloxanes include a finish for reinforced plastics and glass fibres, as reactive diluents for epoxy resins; as reactants to make phenolics, alkyds, polyesters, and other resins more stable to heat; and as a modifier in silicone resins to improve adhesion, solvent resistant, and strength.



Smoke stack at chemical plant coated with aluminum paint based on silicone-organic resin blend.

Union Carbide's Silicone Division offered a silicone resin last year designed for cold-blending with alkyd, melamine, and acrylic type baking enamels to give improved color and gloss retention, thermal stability and resistance to weathering.

General Electric has added to its line a resin which can be baked at as low as 350 degrees F. and still produce excellent degree of hardness. These improved baking properties also permit a significant reduction in curing time at higher temperatures, thereby offering savings in manufacturing time and expense. G-E is also recommending new formulations which utilize a combination of low-vehicle solids and high aluminum content to yield a high-quality heat and salt spray resistant paint. The cost of this formulation is said to be relatively low, considering the nearly 100% silicone vehicle.

New applications are continually being discovered for silicones in protective coatings. For example, a metal lacquer which retains its original high gloss even after extreme weather exposure is a result of incorporating silicones into the formulation.

While silicone products have been commercially available for about 11 years, they have demonstrated a consistent pattern of growth during this period. Largely through the efforts of research and education, silicones are recognized as unique materials to meet high-temperature coating requirements and other specialize coating applications. This is attested to the fact that a commercial silicone paint was applied to the shell of the satellite, Explorer, to resist heat from the rocket inside and to remain light-colored to reflect sunlight.

Solventless Vehicles

The "ideal" solventless vehicle has long been the subject of discussion and speculation by coating chemist. According to Robert Terrill of Spencer Kellogg basic requirements for the "ideal" coating vehicle: no solvent, organic or water; rapid conversion or cure when applied to substrate; workable viscosity; application and handling ease; stability should be indefinitely long; pigmentable with a wide range of pigments; have chemical resistance and durability.

The three major types of solventless coatings are polyurethanes, epoxies and polyesters.

Terrill feels that solventless coatings are not likely to replace either solvent or water-thinned coatings in the forseeable future except in certain applications. The reasons for this opinion is that although solvents are an added cost factor and make for higher vehicle cost at a given film thickness, it is also true that the lowest cost paints are attained in organic solvent systems. Secondly, many solvent and water-thinned coatings have desirable or even necessary application characteristics and these systems are perfectly adequate to meet present service and durability requirements. Finally, the technology and general development of solventless vehicles have a way to go. Since these materials are relatively new, there are many practical obstacles to their adoption and in some areas of utilization. Solvent-free systems also have some disadvantages.

Substantial growth in 100% nonvolatile coatings is predicted by Terrill. Advantages to such coatings are there is no solvent cost, they comprise of solids only; both freight and package savings can be substantial; application costs will be lower since only one coat is usually required; no toxicological or safety hazards due to solvent; if anything properties are more firmly under the control of the

chemist, and most important, solventless coatings are well adapted to machine or mechanical application. One of the factors in the probable growth of solventless coatings is the tendency toward complete prefabrication of construction units which were formerly finished on the job. Prefinished plywood for interior and exterior use is an example.

Water Thinned Resins

While the consumption of latex paints showed a steady growth in 1958, manufacturers of water-base paints were looking to the industrial field for more sales. The big prize is the automotive field. With both Ford and Chrysler now using primers based on latex emulsion, an all out effort is being made to develop satisfactory top coats from water systems. It is the opinion of latex paint producers that by 1965 all automobiles will be finished completely with a water based system. But before the automobile industry accepts these finishes, certain problems must be solved. The big problem is developing a water base system with a gloss that will meet Detroit's specification. Most paint technologists feel that this is just a question of time since fairly good gloss emulsion paints are now possible. Gloss systems based on polyvinyl acetate were brought out by Celanese in 1957. More recently Reichhold came up with an alkyd emulsion which exhibited good gloss. Within the next few months Rohm & Haas will have a thermosetting acrylic emulsion for metal application. This emulsion is said to give excellent gloss and hardness properties in industrial baking enamels.

Some technologists feel that the key to a satisfactory gloss system lies in water soluble resins. One such product is Arolon 1000, a water soluble polymer produced by Archer-Daniels-Midland. Another is a water soluble alkyd made by cooking trimellitic anhydride with adipic acid and glycol. Trimellitic anhydride is available in development quantities from Amoco Chemicals.

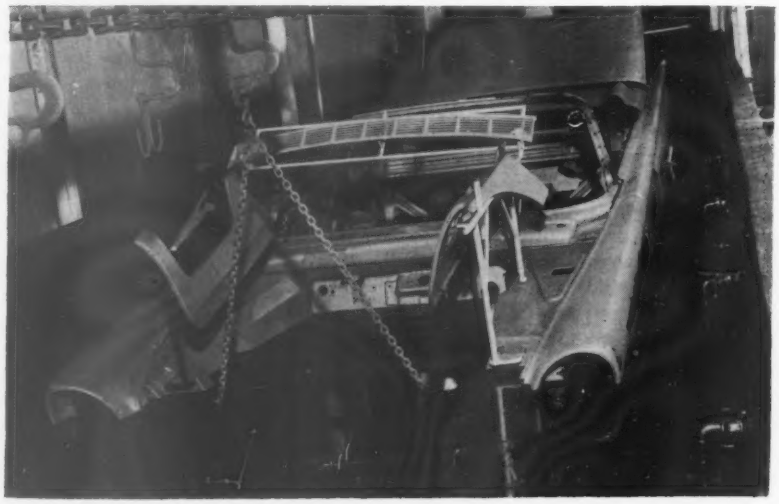
In addition to satisfactory gloss, the water system that the automobile industry will accept must embody all of the film properties that to-day's auto finishes possess. Also, it must fit into the finishing scheme that the automobile industry now uses. Radical departures in application or drying schedules cannot be employed. And, of course, the price of this system must be on par with today's conventional solvent finishes.

In the trade-sales field, latex emulsions have gained widespread popularity among both the professional and "do-it-yourself" painter. Last year's total consumption of latex paint have been placed at 65 million gallons, a gain of 5 million gallons over 1957. With this rate of growth, it has been estimated that the total consumption of latex paints will go beyond 90 million gallons by 1962. According to the most reliable figures available, the 1958 emulsion volume was shared by the following types:

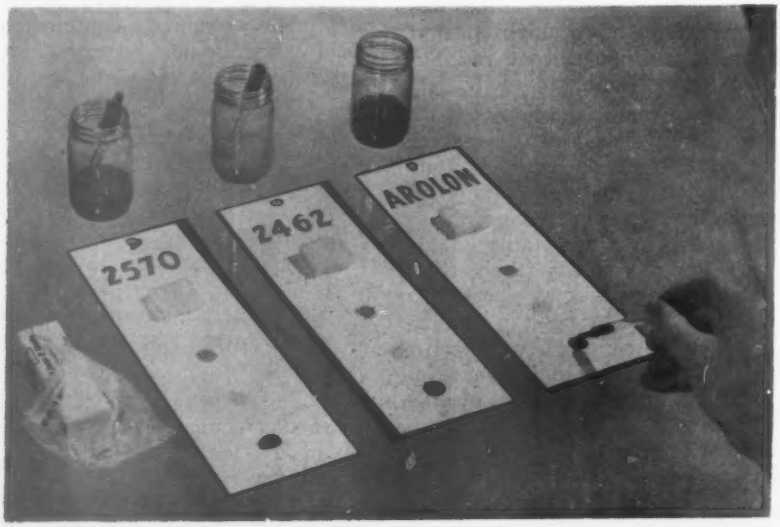
59% – Styrene-Butadiene
29% – Polyvinyl Acetate
12% – Acrylic

In the past year, much technology was directed toward developing satisfactory emulsions paint for application on exterior wood surfaces.

Dow recently announced a new acrylic latex for use on exterior



Lincoln Division of Ford Motor Co. using water-emulsion primer. Shown above is 1958 Lincoln nearly half-way through 9,000 dip tank of latex primer. Dip is used so primer will reach all parts of unitized body. Dip tanks constitute a fire hazard if filled with solvent paint.



Test panels of finishes made with ADM's Arolon 1000 and conventional solvent-thinned resins show this water soluble resin is equal to others in resistance to fruit acids, butter and cooking greases.

wood surface. Although not commercially available, this acrylic latex is being thoroughly tested by some paint manufacturers. Dow claims that its acrylic latex show best durability over both oil primed and self primed wood. Other properties include high moisture vapor transmission rate, good adhesion unaffected by moisture, excellent polymer stability to ultraviolet light, good low temperature film coalescense, and good freeze thaw stability.

Rohm & Haas is also testing its acrylic emulsions (AC-33, AC-55) for application on wood surfaces. According to Rohm & Haas, the present technology requires that a relatively impervious coat, generally an oil paint, be applied to the wood before application of the emulsion system. Recently, recommendations have been made to use a very low PVC paint, in the range of 10% PVC as a first coat on wood. However, the exposure history of this type of prime coat is limited. Furthermore, these coatings suffer rather severly from high cost in comparison to oil systems. This is true at very low PVC but does not apply to the normal PVC used for top coats or primers.

Celanese claims it has found a way to keep exterior polyvinyl acetate paints from peeling and blistering. The technique is to add small amounts of aromatic solvents such as xylene or toluene to water-thinned formulations.

National Starch's recommendation for painting weathered wood surfaces is to use a vinyl emulsion primer which penetrates, binds, and conditions chalky surfaces. Besides conditioning the surface to be painted, these pigmented penetrating primers allow moisture to escape through the film to minimize blistering. This is followed by a top coat of vinyl emulsion exterior paint which, National Starch claims, will give a durable finish that is easily maintained.

Other important advances which took place in latex emulsions are:

(1) Rhoplex AC-55, an acrylic latex, is a high solids modification of Rhoplex AC-33. It is similar in its durability and general properties, but gives better compatibility with many tube color systems, according to Rohm & Haas.

(2) Gelva Emulsion TS-66, a product of Shawinigan Resins, is especially designed for use in gloss paints. Shawinigan claims its formulations for gloss and semi-gloss interior paints compare favorably with conventional oil-based paints.

(3) Gelva Emulsion TS-31, another product of Shawinigan Resins is a specially developed free-filming polyvinyl acetate base for high PVC emulsion paints

(4) Kopper's new styrene-butadiene latex with uniform particle size is said to reduce foam, thus allowing paint manufacturers to increase agitation in processing of latex paints.

(5) Farnow's acrylic-vinyl latex copolymer with low particle size makes it possible to produce paints with high PVC and still maintain good film properties.

Pigments

Pigment capacity is adequate to meet all demands. There are no shortages of chemicals employed in the manufacture of colors and none are anticipated. However, pigment inventories in some major industrial areas may have dropped to very low levels. Rapid recovery in these areas with an accelerated inventory build-up may cause temporary delays in delivery.

A major development in colorpigments was the DuPont's new" Monastral" red pigments introduced to the trade last spring. After ten years of research, DuPont was successful in developing three distinctively different pigment colors from derivatives of the linear quinacridone structure. These include a dark transparent, blue-shade toner, a yellow shade red toner and a dark, transparent red-shade violet toner. These pigments are said to have exceptional color brightness in pastels, outstanding lightfastness at all degrees of dilution, excellent resistance to chemicals, bleed and heat resistance, excellent color stability on storage and outstanding blending properties with other pigments. DuPont feels that this development will permit manufacturers to expand their lines in the red portion of the spectrum to include product not heretofore practical because of pigment deficiencies. Supply was inadequate to meet demands in 1958, but production problems are being overcome and these red pigments are expected to be in ample supply by mid-1959.

Other important achievements in pigment technology during 1958 was the development of lead chromate pigment for metal protective paints by National Lead. This pigment consists of a silica core on the surface of which basic lead chromate has been fused. National Lead claims that this pigment has the proven rust-inhibitive properties of lead and chromium compounds and the weather-resistance of fused basic-lead chromate. Known as M-50 pigment, it can be used in combination with other pigments. Colored and tinted paint containing M-50 are said to possess unusally durable tint retention.

Paralleling this development was Eagle Picher's Permox 143, a basic lead silico chromate pigment for anti-corrosive paints. Particle consists of silica core enveloped in coating or shell of basic lead chromate. This pigment is said to exhibit excellent tint retention.

Chrome yellows of exceptional light fastness were developed by Imperial Paper and Color. This line of chrome yellows is said to show up cleaner and brighter after exposure than conventional types.

Because of their premanent, non-bleed, heat-resistant properties, a new line of Mercadium colors (Imperial Paper and Color) has developed much interest with paint manufacturers.

A very red-shade phthalocyanine blue pigment that is crystal stable was developed by American Cyanamid. Cyan Blue XR-55-3770 is claimed to maintain good initial bright hue and depth of color. Other properties include resistance to bleeding, good light fastness and acid and alkali stability.

There has been a drift away from the bright chromatic shades to the warmer pastels. With this noticeable change, the use of synthetic

iron oxide has been increasing. Tints of iron oxide in white pigments achieve the popular pastel shade.

Another trend has been toward mild dispersion techniques such as sand grinding which require pigments that are free of agglomerates. Columbian Carbon has introduced specially processed yellow iron oxides which are superior to conventional oxides for mild dispersion techniques.

Synthetic iron oxides which are manufactured under carefully controlled conditions are ideally suited for water based systems because of their freedom from water soluble salts.

Color manufacturers are looking to increased usage of all color pigment in the years ahead, primarily because of the tremendous increase in our population which can be translated into more homes, more automobiles, more appliances, etc. where color plays a very important part.

Titanium Dioxide

The paint industry used over 230,000 tons of titanium dioxide in 1957. With the popularity of pastel colors in home decoration and the trend to light automobile finishes, titanium dioxide suppliers are making plans to expand their production to meet the increasing demands of the coatings industry in future years. Glidden, DuPont and National Lead have new facilities for increased capacity of this important pigment. Other producers of TiO_2 are American Cyanamid and New Jersey Zinc.

DuPont's new chloride process is used to produce titanium dioxide at its new plant in New Johnsonville, Tennessee. DuPont claims that titanium dioxide produced by the chloride process has the following properties compared to rutile sulfate grades: ease of wetting, and dispersion in aqueous or oleoresinous vehicles, and general utility as all-purpose pigments in such applications as trade sales paints. DuPont says that chloride pigments appear particularly suited for the water emulsion field because of their ease of incorporation into these systems, and their excellent stability in storage.

Extenders

Progress was noted in the field of extender pigment during 1958, but most of this development was concerned with the introduction of new and improved types of extenders for various paint usage.

Celite diatomaceous silica, a product of Johns-Manville is claimed to find increasing application in the finishes industry. With this increase use in paint, Johns-Manville is maintaining adequate crude inventories and anticipates no shortages or shipping delays on finished products during 1959.

When used with prime pigments, this extender contributes to a uniform pigment packing system for improved paint performance. It is also considered as an efficient flatting agent in formulating flat exterior paints. A flat exterior oil based paint can be formulated at acceptable pigment volume concentrations using 0.5 to 1.5 pounds of diatomite per gallon. It is also contributes toughness and durability and at the same time provides a more "breathing" film to help overcome blistering.

In traffic paints diatomite contributes to greater night visability, faster drying and increased durability. It is also widely used in emulsion paint formulations, principally to provide low angular sheen.

Surface modified silicate pigments are achieving improved performance in paints according to Minerals & Chemicals Corp. of America. These include easier grinding and superior suspension properties, plus greater water resistance and adhesion of the paint film to metallic surfaces.

A low-cost grade of dense-type precipitated calcium carbonate was offered to the paint field for flat wall products by Diamond Alkali. It is said to provide uniform flattening at high PVC and gives reduced streaking, flashing or ghosting of medium shades and deeptones.

Carbon Black

The recent development of water based systems for automotive metal primers has placed a new emphasis on the versatility of carbon black for not only the hidden prime coat, but also for the automotive top coat. Channel and furnace type carbon blacks are meeting the requirements of latex paint shelf goods, as well as water based systems in the paper, fabric and filament fields. According to the Columbian Carbon Co., dry blacks as well as water-dispersed carbon black are being used for tube pastes which are designed for both organic and water based systems. The tube pastes have given very satisfactory results with respect to shade, stability, flooding and floating.

Another development in the paint industry which has received attention of producers of carbon black is the introduction of acrylic lacquers. Carbon black based dispersions for acrylic lacquers have been developed by Columbian which are claimed to yield acrylic finishes of extremely high jetness and gloss—properties which are difficult to achieve with conventional dispersion techniques starting with dry black.

There has been an increasing interest in conductive finishes for applications where the removal of static electricity is important. Columbian offers Conductex SC, a conductive type carbon black.

Solvents

Two developments in the 1958—the increase in usage of latex emulsion paint at the expense of alkyd and oil paints, and the switch of General Motors to acrylic lacquers from nitrocellulos—have affected the solvent picture appreciably. Nitrocellulose lacquers use large amounts of butyl and ethyl acetates and methyl isobutyl ketone while acrylics need acetone and methyl ethyl ketone as their principal solvents. If more automobile manufacturers turn to emulsion primers, xylene and toluene will be affected as these are important solvents in conventional alkyd primers which are still used extensively in the automotive field. Likewise, a switch by Ford and Chrysler from alkyd top coat to acrylic lacquer will mean considerable drop in both toluene and xylene consumption.

All solvents are in ample supply. Some producers of aliphatic solvents see a slight rise in price due to higher labor and processing costs.

Driers, Fungicides and Additives

The supply situation of driers is at present satisfactory. Naphthenic

(*Turn to page 95*)

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Using infrared reflection spectrum and emission spectroscopy in—

Studying Organic Coatings

By
Dr. Max Kronstein*

THIS paper is concerned with instrumental methods for studying organic films, their characteristics and their inter-reaction with the substrata to which they have been applied.

It covers the work of several years under the sponsorship of the Fort Belvoir ERDL Laboratories, and subsequently under industrial sponsorship, utilizing two specific instrumental methods, that of infrared reflectance measurements and that of emission spectrometer studies.

As far as this paper is concerned the various methods are being used without going into detailed discussions of each of the instrumental procedures. These are being presented in separate papers. A detailed report on the infrared reflection spectrometer method and of a new standard for the diffuse reflection in the range to 15 microns will be issued shortly by this author jointly with Robert Kraushaar and Robert E. Deacle. A preliminary report on the application of the emission spectrometer method on the study of the surface reaction of coatings on steel was presented at the 1956 Meeting of the New York Section of the American Chemical Society and has been published since[1]. A second paper on further developments in this method will follow.

Infrared Reflectance Studies on Paint Films

Experimental Approach

The use of infrared absorption spectroscopy in the study of organic chemicals has been developed to a large extent. Specifically, the materials are compared with respect to the intensity of certain absorption bands within certain wavelength ranges in the instrumental record of their absorption spectra, usually between 3 and 15 microns. This method has a very limited use in the study of paint films, because it is very difficult to produce uniform unsupported films of these materials at thicknesses of 0.2-0.3 mils. Greater thickness causes a high degree of absorption and scattering due to pigment particles in the film. Furthermore, very slight differences in thickness occurring in each of two otherwise comparative films might produce variations which are primarily thickness variations and not the result of chemical differences between these films.

It was necessary therefore to develop another method, utilizing the reflectance of such films in the infrared range rather than their absorption spectrum. This method permits the application of film formers to supporting materials and allows a study of the influence which these supporting materials have on the infrared reflectance spectrum. To measure this reflectance, this method uses the following proceedure: A Stupakoff Insulcon Glower (#SL-54.1030) was installed as a light source in the monochromator of a single beam double pass Perkin-Elmer infrared spectrometer, Model 112. Through the exit slit of the monochromator the beam was then projected into a system of mirrors and into an entrance hole of a Coblentz hemisphere. This whole path in the monochromator was kept under nitrogen. This proceedure produced a beam of known wavelength positions which was used to illuminate a test sample mounted in the hemisphere. With a special form of Golay Detector, the total diffuse reflectance of the sample under the illumination by this beam of known wavelength was then measured. To operate the Perkin-Elmer device simultaneously with the Golay Detector the two instrument choppers were operated from the same axle, which was done by extending the axle of the monochromator chopper and attaching the chopper of the Golay Detector to this same axle. The detector was connected with the recorder of the Perkin-Elmer instrument and an instrument chart reading was thus obtained. The Golay Detector was so mounted in the hemisphere as to allow its use in two positions: one for the measurement of the infalling illuminating energy, and a second one for the measurement of the reflected energy. Two curves were obtained for calculating the results. The distance of the detector window from the center of the hemisphere for measuring the infalling energy was the same as the distance of the illuminated specimen in the reflectance measurement. The window of the detector had the same shape as the slit of the hemisphere through which the light beam entered this hemisphere. By

*Research Div., College of Engineering. New York University

This paper was presented at the American Chemical Society Meeting, Div. of Paint, Plastics and Printing Ink Chemistry, April 15, 1958, San Francisco, Calif.

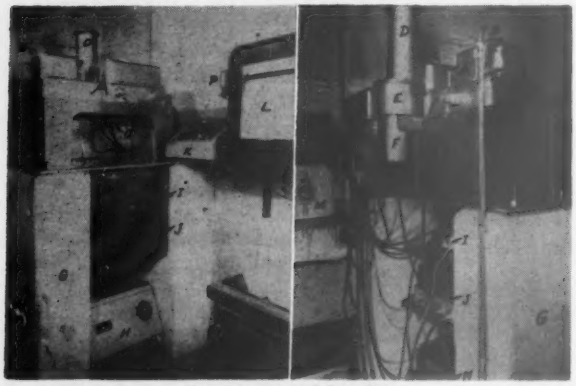
Wave length Range (Microns)	Slit (Microns)	Wave length (Microns)	Band Pass Δ λ Microns	Angstroms
0.545–0.6	200			
0.600–0.7	140			
0.7 –0.85	90			
0.85 –0.9	55			
0.9 –1.02	35	1.0	0.00038	3.8
1.02 –2.4	25	2.0	0.0030	30.0
2.4 –2.9	25	3.0	0.00498	49.8
2.9 –4.0	29	4.0	0.00615	61.5
4.0 –4.5	38			
4.5 –5.5	49	5.0	0.00625	62.5
5.5 –6.45	70	6.0	0.0062	62.0
6.45 –7.95	90	7.0	0.00624	62.4
7.95 –9.7	130	8.0	0.00635	63.5
		9.0	0.0064	64.0
9.7 –12.6	200	10.0	0.0072	72.0
		11.0	0.0092	92.0
		12.0	0.0130	130.0
12.6 –13.7	400	13.0	0.0128	128.0
13.7 –14.4	650	14.0	0.0212	212.0
14.4 –15.0	1400	15.0	0.0217	217.0

The band pass Δ λ was calculated using the equation: (Perkin-Elmer Manual Vol. I)
$\Delta \lambda = \Delta \lambda_p + \Delta \lambda_{0.1} \times \text{slit width} / 0.1$
Hereby $\Delta \lambda_p$ is the prismatic resolution for infinitely narrow slits
and $\Delta \lambda_{0.1}$ the increamental resolution for 0.1 MM slit width (half energy spectral slit width).

Table 1. Slit width and band pass data.

the use of the Stupakoff Glower, a light source of greater energy was obtained for the spectrometer, allowing its use over a range from about 0.7 to 15 microns without changing the prism in the instrument. The slit width used with the instrument and the band pass are shown in Table 1.

In order to allow a calculation of an absolute reflectance value, it was necessary to develop two standards of reflectance which were expected to be as constant as possible over the whole test range to 15 microns. The reflectance of surfaces which had a considerable spectral reflectance component were measured against the reflectance of a Rhodium mirror. The reflectance of primarily diffusely reflecting surfaces was measured against the reflectance of a form of sulphur which contained a considerable amount of the insoluble Mu form such as the heat sublimed "Flowers of Sulphur", or the heat vaporized and quenched high polymer sulphur. The development of this standard and the calculation factors for the various measurements are the subject of a separate paper since they would be beyond the scope of this report.



Instrumental Set Up
Figure 1 (left: front) and Figure 2 (right: back). (A) Spectrometer; (B) Light source; (C) Location of exit beam; (D) Reflection/mirror system housing; (E) Hemisphere casing; (F) Detector housing; (G) Concrete foundation; (H) Power Supply; (I) Amplifier for spectrometer; (J) Amplifier for detector; (K) Control panel; (L) Recorder; (M) Battery charger; (N) Battery box; (O) Chopper; (P) Hydrometer/thermometer; (Q) Tubing for nitrogen.

The general instrumental set-up is shown in Figures 1 and 2.

Hiding Power and Wavelengths

Customary measurements of hiding power use applications of paint coatings to white and to black surfaces and illuminate these with an electric bulb, that is, with a bundle of different wavelengths, without considering the intensity of the various wavelengths which are present in this lightsource. The reflectance caused by this ilumination is measured and the hiding power of the paint film is expressed as the measured percent of reflectance over a black surface divided by the measured percent reflectance over the white surface times one hundred. In this manner comparative values for the hiding power of different paints of the same film thickness have been obtained.

In this study it was of interest to determine how constant the ratio of hiding power remained between 1 and 15 microns (the range of this study). In order to obtain these values the paints were applied to two different metal surfaces: one a surface of known high degree of reflectance at the various wavelengths, that is, to polished aluminum (Figure 3); the other an aluminum having a black undercoat of a very low degree of reflectance. The hiding power was then determined for each wavelength as:

$$\frac{\text{Reflectance over Black}}{\text{Reflectance over Polished Aluminum}} \times 100$$

The hiding power tests here reported refer to alkyd paints which were selected from the group of various paints used during the investigation. Table 2 shows the composition of two iron oxide paints and of two chrome green paints, using in each case two different iron oxides and two different chrome greens for a double check on the test results.

In order to obtain comparative paint applications all paints were prepared with a P.V.C. of 20%. The aluminum panels were polished before paint application with a buffing wheel, then washed with ethyl acetate to obtain a clean grease free surface. Before dipping the panels, using the Fisher-Payne Dip Coater with slowest speed, the paints were diluted with xylene to such a viscosity as was most suitable for un-

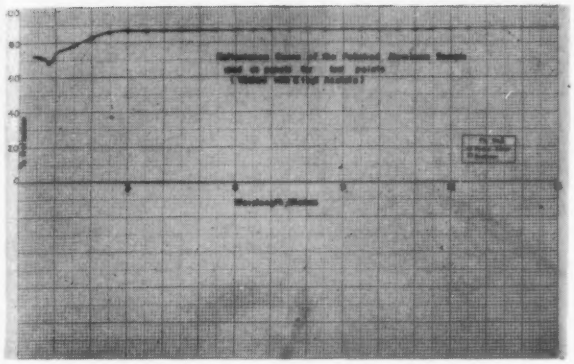


Figure 3. Reflection curve of the polished aluminum.

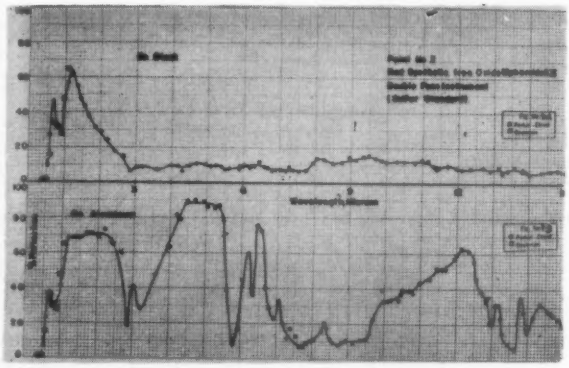


Figure 4. Reflection curve of spheroidal red iron oxide. Paint on black and on aluminum.

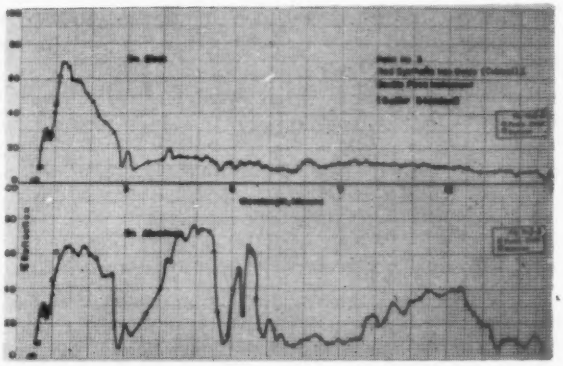


Figure 5. Reflection curve of cubical red iron oxide. Paint on black and on aluminum.

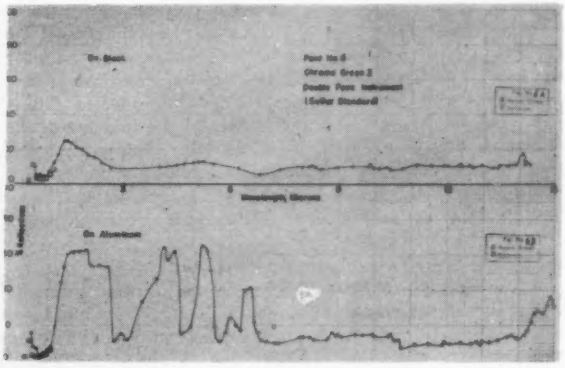


Figure 6. Reflection curve of chrome green I. Paint on black and on aluminum.

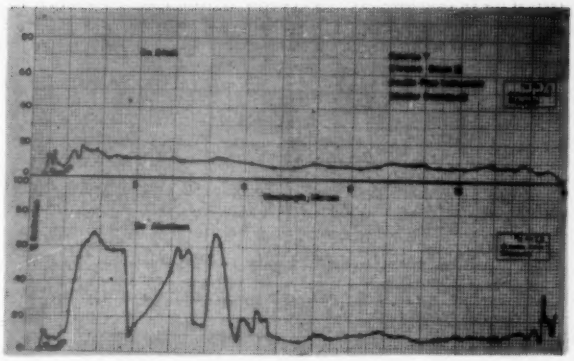


Figure 7. Reflection curve of chrome green II. Paint on black and on aluminum.

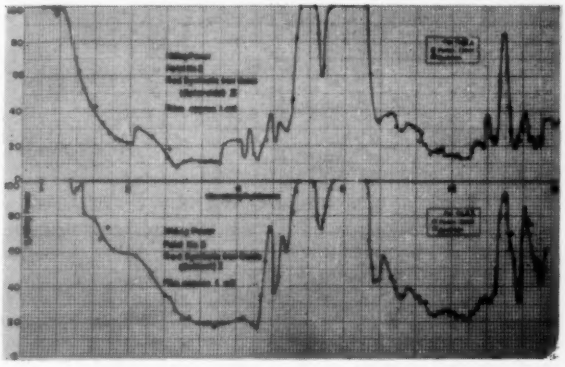


Figure 8. The hiding power curve for the spheroidal and the cubical red iron oxide paints.

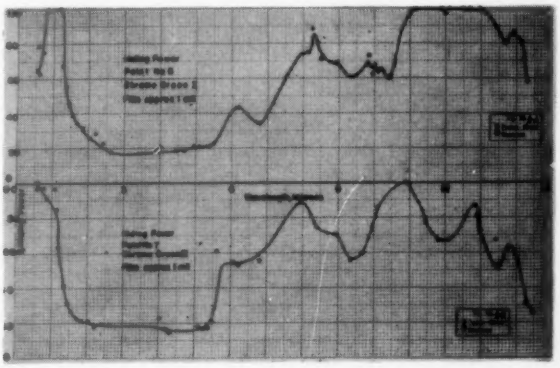


Figure 9. The hiding power curve for the two chrome green paints.

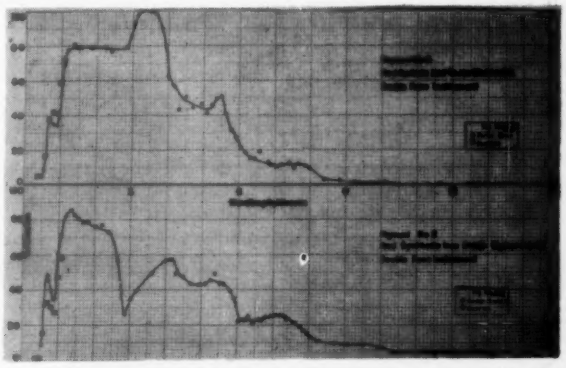


Figure 10. Reflection curve for the two red iron oxides as pigments.

Synthetic iron oxide paints	LBS/GAL	Composition
Paint #2:		
Spheroidal red iron oxide (Mapico red #347) Referred to as iron oxide II.	43.14	120 parts red iron oxide 200 parts alkyd resin 55% solids (Rezyl resin #387-5) 100 Parts xylene
Paint #3:		
Cubical red iron oxide (Mapico red #110-2) Referred to as iron oxide I.	41.98	120 Parts red iron oxide 200 parts alkyd resin 55% solids (Rezyl resin #387-5) 105 parts xylene
Chrome green paints		
Paint No. 6:		
Chrome green I: vale green A 4444	33.8	97 parts chrome green 200 parts alkyd resin 55% solids (Rezyl Resins #387-5) 90 parts xylene.
Paint No. 7:		
Chrome green II: Hudson green A-701	33.8	97 parts chrome green 200 parts alkyd resin 55% solids (Rezyl resin #387-5)

P.V.C. = 20%

Table 2. The test paints.

iform dip coating and which produced a film as close as possible to 1 mil dry film thickness. After the panels were allowed to dry to touch, they were placed in a 50°C. oven for 72 hours and stored in a desiccator until actual testing.

In studying the results of the hiding power values, we see that Figures 4 and 5 (iron oxide and I and II) and Figures 6 and 7 (Chrome green I and II) show generally good agreement in the pattern of their reflection spectra on black as well as on aluminum. It is evident that the percent reflectance on black remains, in all four cases, quite constant after 3 microns, due to the increased transparency of the film which allows the black undercoat to lower the reflectance of the paint film. In applications of the paints on polished aluminum there is no uniform high reflectance spectrum. The paints are considerably more transparent at certain wavelengths and the high reflecting aluminum is more visible than on others, with characteristic low reflectance values at about 3 microns, between 5 and 5.5 microns, and after 7 microns. These areas were observed on other test paints also. The increase in reflectance between 10 and 12.5 microns also was observed on several test paints in the course of the investigations but not on all.

By dividing point by point the percent reflectance values over black by that on aluminum, it is evident that the resulting ratio or "hiding power" also varied for different wavelengths (see Figures 8 and 9), with a low hiding power range at around 3 and 5.5 microns. This also was observed on paints with other pigmentations. That these variations of the hiding power are not typical for the reflectance of the dry pigments is shown in Figures 10 and 11, where the reflectance spectra of the same dry pigments are shown. Here the dry pigments show a considerable drop in reflectance at around 3 microns. This is typical for many pigments including the magnesium oxide, which had generally been used as a standard of reflection in the visible range. But this drop is different from that observed on pigmented paints as far as it remains in the lower limit of the test range at 15 microns.

In summerizing this part of the studies, it has been shown that the hiding power of paint films varies with the wavelength of the illuminating light source and that the hiding power of a paint of given thickness has no constant value for all wavelengths.

Effect of Pigmentation on Water Penetration

The same approach for measuring the reflection of a paint film over aluminum and over black was utilized for the study of the reflectance changes which might occur when painted surfaces are immersed in water and then recovered again, or if they are immersed in salt water. The immersion times are shown in Table 3. All tests were made on aluminum as well as on black; however, the figures in this report are limited to specimens on aluminum because the black background samples produced less characteristic variations than those on aluminum. The composition of the test paints used in this study is given in Table 4. The paints were again applied at a thickness as close as possible to 1 mil and were tested in dry condition, again after 72 hours water immersion in distilled water, and finally after the films had been allowed to dry at 30°C. for 24 hours. Some of the films were immersed in 5% NaCl for 24 hours and were tested again.

1. The reflection spectrum of the dry paint film.
2. The reflection spectrum of the paint film after 72 hours water immersion.
3. The reflection spectrum after the paint film was allowed to dry again at 30°C. for 24 hours.
4. The reflection spectrum after immersion also in 5% NaCl for 24 hours.

Table 3. The sequence of the immersion tests.

In Figures 12-14 three synthetic iron oxide paints were compared which differ in particle shape of the pigment only. The iron oxides used were in acicular form (Figure 12), in spheroidal form (Figure 13), and in cubical shape (Figure 14). Of these three shapes the cubical pigment showed the greatest degree of effect of the water immersion, which occurred in the range beyond 3 microns, although the reflection values were mostly restored after the paint was allowed to dry again. The results of the immersion of a platy wet ground mica paint were interesting (Figure 15), since here the spectra were nearly identical in dry, in immersed, and in recovered condition. Nearly no effect of the immersion was observed in the case of a pigmentation with a hexagonal white lead, although here the paint was immersed in salt water also (Figure 16). A mixing of the hexagonal white lead with chrome oxide in a ratio of 1:1 did not change these results (Figure 17). Generally, the effect of the water immersion was not as great as had been expected.

These are a few of the applications of the infrared reflection technique on the study of paint films. Other applications of this technique may be a comparative study of different vehicles with the same pigmentation, a study of different pigment/volume concentrations, a study of different forms of drying or of different drying times.

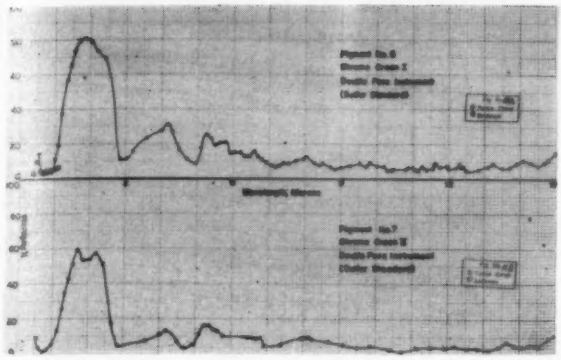


Figure 11. Reflection curve for the two chrome greens as pigment.

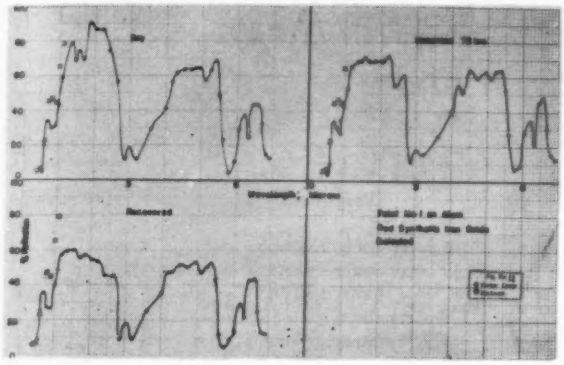


Figure 12. Immersion effect of acicular red iron oxide paint.

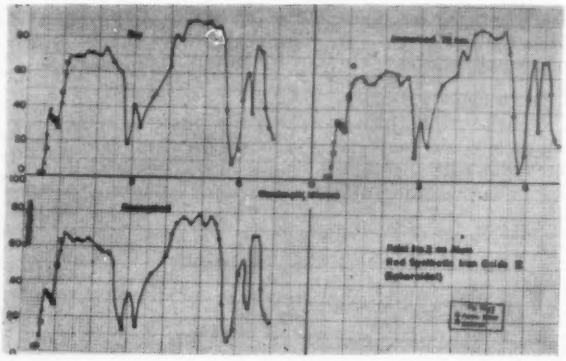


Figure 13. Immersion effect of spheroidal red iron oxide paint.

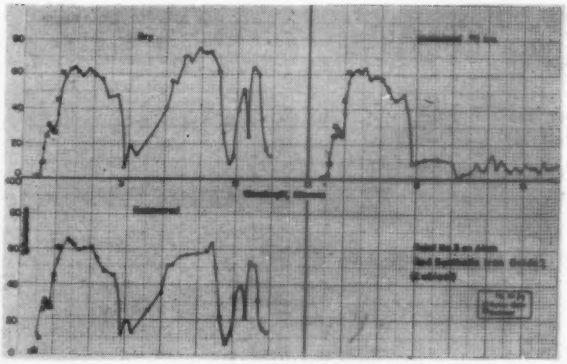


Figure 14. Immersion effect of cubical red iron oxide paint.

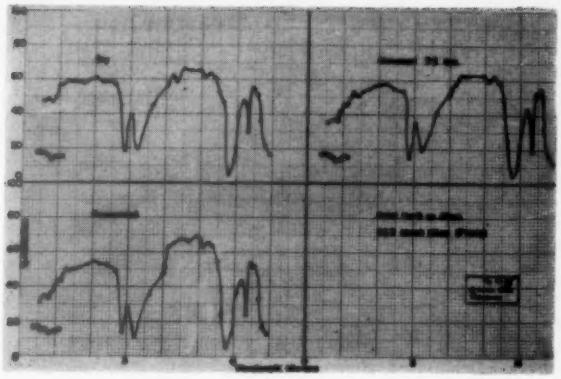


Figure 15. Immersion effect of platy mica as paint.

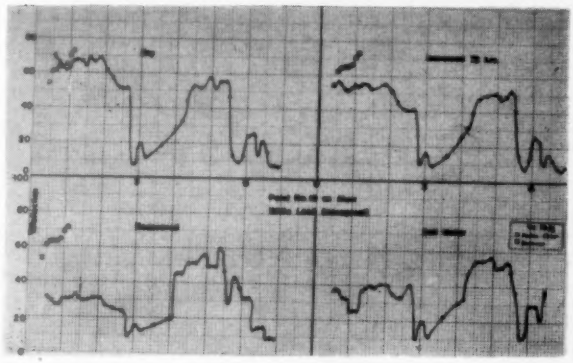


Figure 16. Immersion effect of hexagonal white lead as paint.

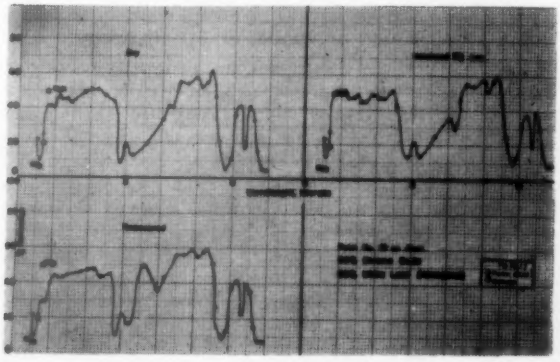


Figure 17. Immersion effect of paint with 50% chrome oxide and 50% hexagonal white lead.

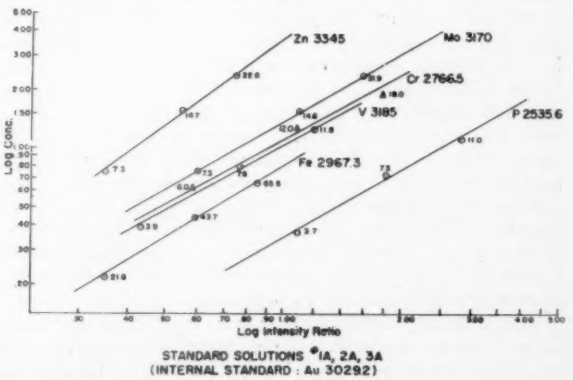


Figure 18. Calibration curve for the components of the stripped coatings.

	LBS/GAL.	Composition
Synthetic iron oxide paints:		
Paint #1		
Acicular red iron oxide (Mapico #516 Dark)	37.65	120 Parts red iron oxide 200 parts alkyd resin 55% solids (Rezyl resin #387-5) 120 Parts xylene
Paint #2		
Spheroidal red iron oxide (Mapico red #347) Referred to as iron oxide II.	43.65	120 parts red iron oxide 200 parts alkyd resin 55% solids (Rezyl resin #387-5) 120 parts xylene
Paint #3		
Cubical red iron oxide (Mapico red 110-2) Referred to as iron oxide I.	41.98	120 parts red iron oxide 200 parts alkyd resin 55% solids (Rezyl resin #387-5) 105 parts xylene
West ground mica, 325-mesh:		
Paint #9	23.49	66 parts mica
Platy wet ground mica, 325-mesh		200 parts alkyd resin 55% solids (Rezyl resin #387-5) 115 Parts xylene
White lead and mixture:		
Paint #16		
Hexagonal white lead	56.0	156 parts hexagonal white lead 200 parts alkyd resin 55% solids (Rezyl resin #387-5)
Paint #18		
Hexagonal white lead and Chrome oxide X1134	——	79 parts hexagonal white lead 49 parts chrome oxide (Mixed 50:50 by volume) 200 parts alkyd resin 55% solids (Rezyl resin #387-5)

P.V.C. = 20%

Table 4. The test paints of the immersion tests.

Applications of Emission Spectroscopy

The second part of this paper is concerned with physical and chemical methods for studying an inter-reaction between a paint film and the surface to which it is applied. In this case an especially reactive coating was selected, the polyvinyl-butyral-zinc tetra oxychromate primer, or "wash primer" Of interest was to determine how far the chemical reaction progressed between the primer and a 1010 steel surface to which it is being applied.

In a preceding paper this research group has shown how the chemical composition of a phosphatized steel surface can be studied by dissolving the chemically produced surface layer in a chemically pure hydrochloric acid-formaldehyde solution, and determining by weight the amount of the dissolved matter. Then the solution was concentrated to below 40 cc and was rediluted to a 40 cc volume. A standard material was added to the solution and the emission spectrum of this solution was determined. As internal standard material, a solution of gold chloride was used. The intensity of the resulting lines for the different components was compared with the same bands in three standard solutions of known concentration, and from calibration curves the components in the coating were determined in milligrams for the amount of dissolved matter (Figure 18). The instrument which was used for the analysis was the 1.5 meter Spectrograph with the Film Comparator Densitometer of the Applied Research Laboratories, together with the attachment for the rotrode technique in the testing of these solutions. This method has now been extended further to a study of the inter-reaction layer which results from an application of the wash-primer.

This is based on the consideration that if such a wash-primer actually produces a similar interface coating on steel as is obtained from phosphatizing processes, it is to be expected that such a coating could consist of components of the same group of materials as used in the analytical method for phorsphatizing reactions: iron (from the base material), zinc (from the zinc oxychromate), chromium (from the same chromate) and phosphorus (from the phosphoric acid additive).

Experimental Approach

Three panels for each test group were dipped into the wash-primer and the paint was allowed to dry for a certain time interval. This interval was varied in the course of the test groups as shown in Table 5. After each immersion and the

(Turn to page 72D)

Series	Paint and 1010 steel T-2	T-4	T-8	T-10 (WP-2)
Drying time for each coat (min.)	2	4	8	10
Stripped matter from six panels (mg)	17.4	20.8	21.6	42.5
Stripping weight (mg/sq. ft.)	57.15	73.49	71.52	60.15
a) Spectro analytical results in mg. contained in the stripped material				
P	0.425	0.70	0.425	1.675
Cr	0.00075	0.001	0.001	0.30
Fe	2.575	5.625	2.55	5.625
Zn	4.15	3.55	3.90	7.75
b) Results calculated in % of stripped coating				
P	2.44	3.365	1.976	3.95
Cr	0.0043	0.0048	0.00315	0.70
Fe	14.8	27.0	11.80	13.22
Zn	22.35	17.07	18.05	18.23

Table 5. Composition of the stripped coatings (four different contact times).

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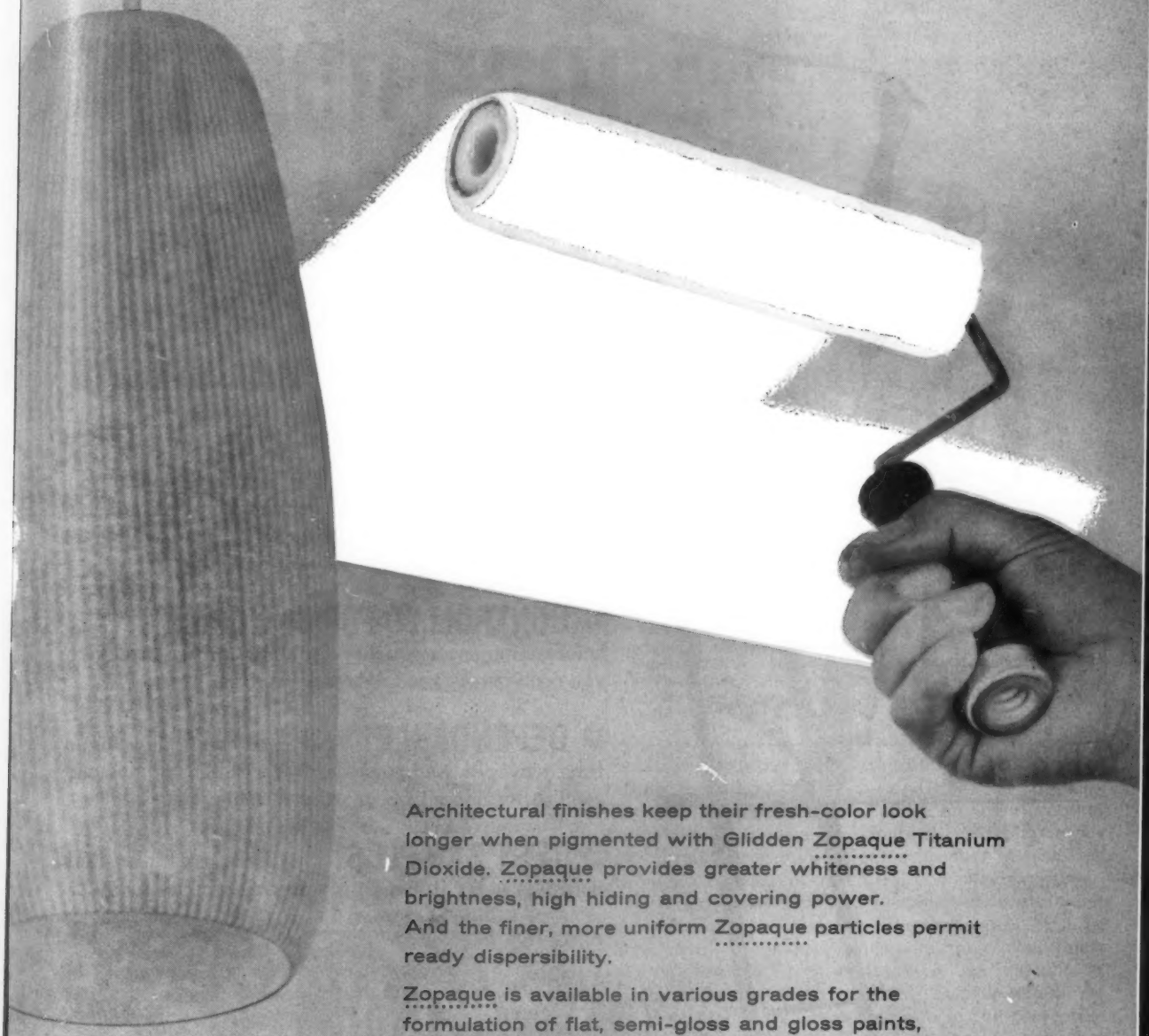

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A Staff Report

Cyclized Rubber in Protective Coatings

Part I

Beginning with this issue, Paint and Varnish Production is pleased to present a comprehensive series of articles on the use of cyclized rubber in surface coatings. This first installment is concerned with the physical and chemical behavior of cyclized rubber and such important paint technological properties as compatibility, solubility, film build and solvent requirements, and plasticization. Part II, scheduled for the February issue, will cover such important factors as storage stability, brushing and leveling properties, film formation and drying, and pigmentation.

ADVENTUROUS and colorful is the history of natural rubber from the time of its discovery to its present day's position of tremendous technical importance. No one could comprehend the enormous role rubber would play in the future when, in 1739, the Frenchman de la Condamine showed the first piece of rubber to the Acadamie Francaise in Paris.

With the introduction of the vulcanization process by Goodyear, and the development of industry in general, the interest and the use for this unique product gained steadily.

At an early stage science displayed considerable interest in natural rubber, which developed into an important field of chemical research and industrial application. As a high polymer of nature, rubber remains an interesting research object of high polymer chemistry.

The knowledge of its chemical make-up and synthesis are important achievements, opening numerous avenues for possibilities. The work of many researchers marks the road from the product produced in tropical forests by nature to the modern rubber production by chemical synthesis, a road paralleled by struggles for monopolies, power and markets.

As early as the last century, chemists tried to utilize natural rubber for surface coating purposes. Through treatment with chemicals, some rubber derivatives were produced which had little practical value. The introduction of chlorinated natural rubber finally presented the surface coating industries with a usable product. This was not the only product. Research continued its efforts to find other use possibilities for rubber in the surface coating industries. The aim was to create a product having durability and chemical resistance, combined with favorable film-forming properties. Such a product was created through catalytic isomerization of natural rubber. Cyclization of the long chained rubber molecules takes place during the process. The cyclization can be forced into various directions and a range of products may be obtained which, for example, are insoluble or alternatively completely soluble. Such a soluble reaction product was offered for sale to the protective coating industries in the United States before the last war. These products were, however, of limited use.

During the "thirties" the research laboratory of the *Chemische Werke Albert*, Germany, carried out the work which resulted in a cyclized rubber possessing excellent technological properties. The result is the cyclorubber "Alpex." The conditions caused by war and the years following resulted in a delay of production from the year 1938, in which the basic patent covering this process was obtained, until the year of 1951.

CHEMICAL and PHYSICAL BEHAVIOR

As a product derived from natural rubber, "Alpex" is practically a pure hydrocarbon. No chlorine or similar materials are introduced into the molecular complex during the process of transferring the natural rubber into cyclized rubber but impurities and other chemical components usually present in the natural rubber are eliminated during the manufacturing process. The cyclization of the long chained rubber results in the formation of highly condensed hydroaromatic ring systems.

Despite intensive research, it is not possible up to this date to present a proven structural formula for cyclized rubber.

Physical Properties	*Alpex*
Specific gravity: 25°C.	1.000
Wt. per Gal.: 25°C.	8.33
Bulking Value: 25°C.	0.120
Index of refraction: 25°C.	1.535
Color U.S.D.A. scale	M
Color Gardner 1933, 60% in mineral spirits	13-14
Melting point B & R ASTM	145-155°C.
Melting capillary method [37 K.B. Value]:	125-135°C.
Viscosities in M.S., (Gardner-Holdt Scale at 25°C.)	
60% Solids	Z_6
50% Solids	Z_1
40% Solids	S
30% Solids	C-D
Molecular weight (average)	5,000-10,000
Iodine Value	75-95
Acid value	0-1
Saponification Value	0
Heat distortion point	200-250°C.
Heat stability	150-200°C.
Effect of sunlight	None
Effect of aging	None
Burning rate	Very slow
Dielectric constant 1000 cycles	1.35-1.50
Specific Surface Resistivity Ohm.	10^{17} Ω
Sward Hardness, % (Glass 100%)	50-60

Table I. Physical properties of cyclized rubber.

The intra-molecular process of cyclization naturally causes changes in the starting material. For one, the number of olefinic linkages or double bonds are reduced, making cyclized rubber more saturated than the starting material. The extraordinary oxygen sensitivity of natural rubber is, therefore, greatly reduced. The low degree of unsaturation of the cyclized rubber causes the formation of films from the resin solution not only by physical means, but also by a slight oxidation-crosslinking process, with the result that such films gradually lose their solubility in aliphatic hydrocarbon solvents. This process can be accelerated through the addition of metallic driers or stopped through the use of inhibitors. Through the use of driers or inhibitors the actual drying time of a film is not altered. The action of a metallic drier carrying a film into its insoluble state is clearly noticeable.

Furthermore, cyclization produces a lower molecular weight polymer than that of the starting material. In comparison with the molecular weight of natural rubber of several 100,000, the average molecular weight of cyclized rubber is about 5,000. These changes in the molecular weights are demonstrated when the viscosities of natural and cyclized rubber are compared. It is hardly possible to prepare more than a 5% solution of natural rubber in aliphatic low boiling solvents, having, in many instances, a gel-like appearance, whereas a 50% solution of cyclized rubber can be prepared easily.

The formation of ring structures stops almost entirely the movement of the chains, causing an alteration of the highly elastic properties of the rubber to a high melting, resinous substance, with horn-like strength and hardness. Of importance is that cyclized rubber has greatly improved heat resistance, compared with natural rubber, and its flammability is reduced. It must also be mentioned that through the process of cyclization density and refractive index increase. Despite all the changes mentioned above, the outstanding properties of natural rubber have been retained in the cyclized rubber. This resin is the result of well-planned research work, with the aim to serve the interests of the surface coating industries. The old problem to convert natural rubber into a suitable varnish resin was solved, and a novel raw material having very interesting properties has been placed at the disposal of the paint and varnish industry.

PAINT TECHNOLOGICAL PROPERTIES

The successful use of a vehicle depends upon numerous properties which must be well known to the formulator in order to design a surface coating system fulfilling his requirements. The following summary is given to present as clear as possible a picture of the unique properties of this resin. Therefore, it gives much more detail than normally expected in a specification. Only by fully understanding the numerous properties special to cyclized rubber, one can obtain some idea of using all the outstanding properties of the resin.

General Properties

"Alpex" is offered to the paint industry in the form of a 60% solution of medium viscosity in mineral spirits, or as a 100% solid hard resin. The solution has a solids content of 60% (2 hours at 200°C.) The melting point, using the capillary method, lies at about 135°C. The acid number is zero; the resin is practically neutral. A 25% solution of the resin in regular mineral spirits has a viscosity of 30-40 cps. at 20°C.

Compatibility

As will be demonstrated later, the use of cyclized rubber in combination with a suitable plasticizer often gives best results. The necessity of a combining with other film formers, is however, often required to satisfy the demands created by the great diversity of coating formulations requested today. There are always compatibility limitations, caused by the chemical properties of a resin, restricting the formation of suitable films in a great many instances.

Table II lists a number of resins, oils and plasticizers, indicating their compatibility with cyclized rubber.

Cyclized rubber is compatible with modified phenolic resins, maleic resins, drying oils, Standoils or bodied oils, alkyd resins, and a number of special

Compatibility With "Alkydol" Resins	
Limed Rosin #220	x
Zinc resinate #230	x
Tall oil Esters, "Alkytall" G and P	x
Estergums 103, 105	x
Maleic resin 121	x
Phenolic resin 109-A	x
Phenolic resins 100%	b
Long oil modified alkyds:	
S-1103	x
S-1107	x
S-2014	x
S-1043	x
Medium oil modified alkyds:	
S-1004-A	x
S-1116-A	x
S-1116-B	x
S-1134-A	x
S-1400-B	x
S-1406	x
Compatib.lity With other Film Formers	
Linseed oil	x
Linseed standoil	b
Woodoil raw	x
Bodied woodoil	b
Nitrocellulose	0
Ethylcellulose	b
Chlorinated rubber	0
Abitol (Hercules Powder Co.)	x
Butyl rubber	0
Hercolyn (Hercules Powder Co.)	x
Polyvinyl ether	b
Polyacrylic butyl ester	b
Acrylic acid butyl ester-copolymer with Vinyl-Isobutyl ether	b
Asphalt, high m.p.	b
Asphalt, low m.p.	x
Cumar	b
Di- and Tri-isocyanate	b
Melamine resins	x
Urea resins	b
Polyisobutylene	0
Paraffin Wax	b
Chloro paraffin 40	b
Chloro paraffin 70	b
Chlorinated Diphenyl	x
Diphenoxy Ethyl formal	b
Di-octyl-phthalate	x
Di-butyl-phthalate	b
Paraffin oil	b
Unsaturated mineral oil fractions	x
Castor oil	b
Dimethyl-thianhren	x
Trichloro ethyl phosphate	b
Tricresyl-phosphate	b
Microcrystalline wax	b

Legend: Compatibility tests were made using a 60% "Alpex" solution in Mineral Spirits.
(x) = Complete compatibility
(b) = Limited compatibility
(0) = No compatibility

Table II. Compatibility data of cyclized rubber.

plasticizers. It is also compatible with mineral oils. It is not compatible with non-drying oil alkyds, various amine resins, nitrocellulose, chlorinated rubber and polyvinyl chloride. The tolerance for, or compatibility with drying oils and alkyd resins depends on the degree of polymerization, the oil content and composition of the alkyd resin. Compatibility is also influenced by solvents and driers which prevent haziness of films in many instances. Generally, non-polymerized oils may be combined with cyclized rubber in the ratio of 3 parts of oil to 1 part of cyclized rubber. Alkydol S-1043 has proven itself most suitable in combination of cyclized rubber and an alkyd resin. It is recommended as a blend of 1 part of cyclized rubber to 3 parts of alkyd resin on a solids basis. Other alkyd resins can also be blended with cyclized rubber. The compatibility of cyclized rubber and alkyd resins can often be greatly improved through the incorporation of plasticizers.

Solubility

Considering the solubility properties of "Alpex," one has to differentiate between the solubility of the solid resin and the dilution of its 60% solution in mineral spirits. The latter is of great importance to the surface coatings industry, because the solution is mostly the starting material, using mineral spirits as the preferred solvent.

Solubility of the solid resin	
Mineral spirits	X
VM&P naphtha	X
Xylene	X
Decalin	X
Turpentine	X
Carbon tetrachloride	X
Ethyl alcohol	O
Butanol	O
Ethylene glycol	O
Butyl acetate	O
Acetone	O
High-flash naphtha + Ethyl alcohol, 1 : 1	O
High-flash naphtha + mineral spirits 1: 1	X
Xylene + mineral spirits, 1 : 1	X

Note: X = unlimited solubility O = insoluble

Table III. Solubility properties of cyclized rubber.

"Alpex" in form of a 60% solution can be further reduced with aliphatic and aromatic hydrocarbons, turpentine, decalin, tetralin, dipentine and cyclohexanone. The hydrocarbon solutions have a limited tolerance for esters. Practically as already indicated, mineral spirits is used as the sole solvent, a fact which is of great importance to the producer and user of surface coatings. The advantage of complete mineral spirits solubility distinguishes cyclized rubber from other products derived from rubber.

Film Build and Solvent Factors

The property of "Alpex" to form solutions of relative low viscosities and high resin concentrations results in the formation of relatively thick films after solvent evaporation. A brushable cyclized rubber-mineral spirits solution can have as high as a 40% resin solids concentration. Such a high resin content of a solution is important for practical application purposes because the total film thickness of a coating is of fundamental importance for the durability of the protective coating system. This also means that in many in-

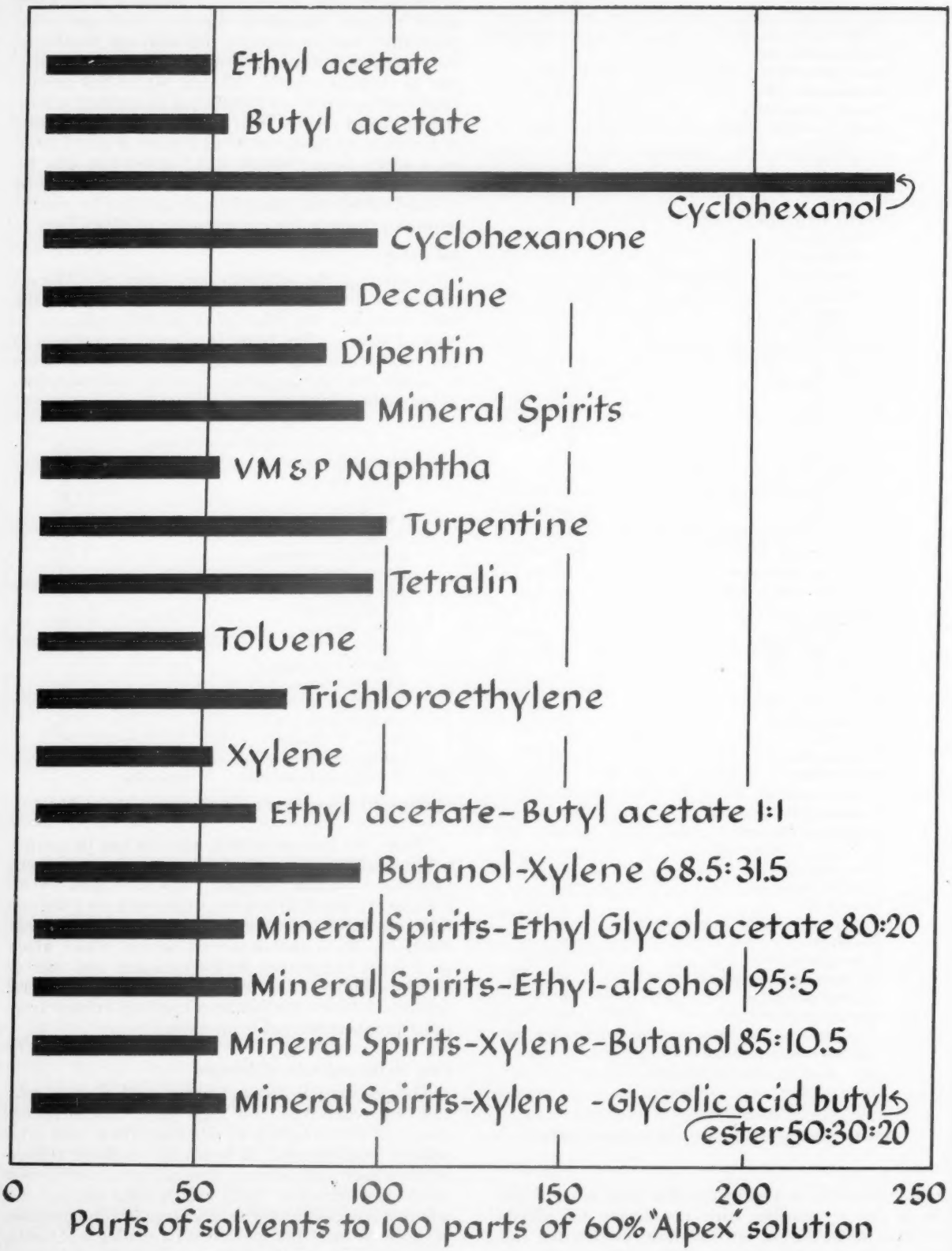

Figure 1. Solvent requirements of cyclized rubber.

Dilution of the 60% solution

Mineral spirits		X
VM&P naphtha		X
Benzene		X
Toluene		X
Xylene		X
Decalin		X
Tetralin		X
Turpentine		X
Dipentine		X
Trichlorethylene		X
Tetrachloroethylene		X
Methanol		O
Ethanol		B
Butanol		B
Cyclohexanol		B
Ethylacetate		B
Butylacetate		B
Ethylene glycol		O
Acetone		O
Cyclohexanone		X
Mineral spirits	50%)	
Xylene	30%)	X
Butyl glycol	20%)	
Mineral spirits	85%)	
Xylene	10%)	X
Butanol	5%)	
Mineral spirits	95%)	X
Ethyl alcohol	5%)	
Mineral spirits	80%)	X
Ethyl Glycol acetate	20%)	
Ethyl acetate	50%)	B
Butyl acetate	50%)	
Butanol	68%)	B
Xylene	32%)	

Note: X = unlimited tolerance. B = limited tolerance.
O = no tolerance.

Table IV. Dilution of the 60% cyclized rubber solution in various solvents.

stances fewer coats can be applied, resulting in saving of time and material.

Figure 1 demonstrates solvent requirements for the preparation of cyclized rubber solutions. The quantity of solvent or solvent mixture is given in parts by weight which is needed to reduce the viscosity of 100 parts by weight of the 60% cyclized-rubber solution in mineral spirits to a viscosity of 60 sec. measured with a Number 4 Ford Cup at 20°C.

Plasticization

The hard, resinous properties of cyclized rubber exclude its use as such for protective coatings, and plasticizers are needed, depending upon the problem confronting the coatings formulator. As plasticizers, drying oils, alkyd resins, or special plasticizers can be used.

The combination with drying oils and alkyd resins results only in coatings of limited chemical resistance caused by the saponifiability of the drying oil components. To resist the aggressive action of chemicals over long periods of time, plasticizers must be selected accordingly. Practically "Alpex"-oil and "Alpex"-alkyd resin combinations are used together with unsaponifiable plasticizers.

As shown in Table II, "Alpex" is compatible with numerous plasticizers. Preferred are the chemical resistant types such as Aroclor (1) and Chloro-paraffins, etc. Phthalic acid esters and other saponifiable plasticizers are rarely used due to their limited chemical resistance. The quantity of plasticizer to be used depends upon the end use of the coating. Generally, the maximum quantity of plasticizer used is about 60%, calculated on the amount of solid resin for paints of high coverage. In certain cases, especially for primers, the plasticizer ratio may be higher than 60%. Figure 2 indicates the variation in the film hardness by type and quantity of plasticizer. It shows the hardness of cyclized rubber films after four weeks aging depending on the quantity of plasticizer used, determined with the Albert-Koenig Hardness Tester. (Film thickness 30-35 microns). All plasticizers, when used in a quantity of 30% with the exception of diphenoxy-ethyl-formal give approximately the

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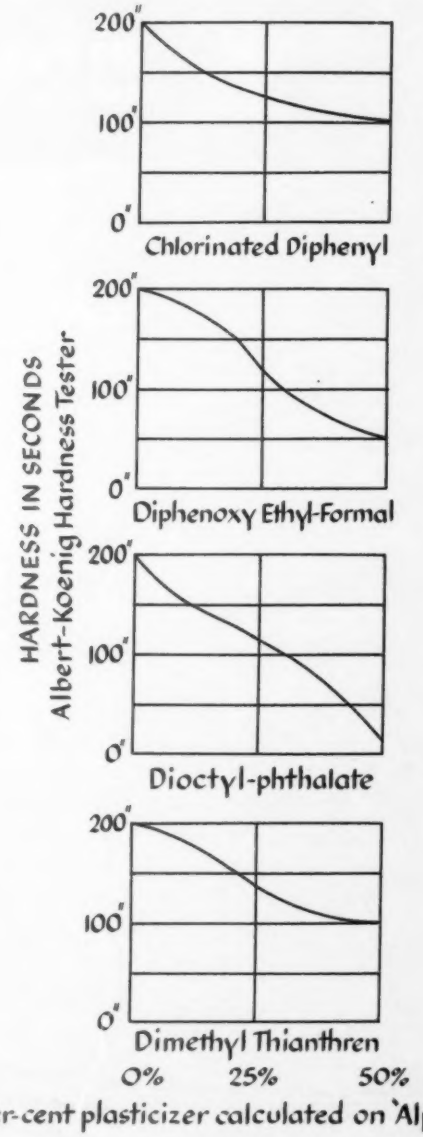
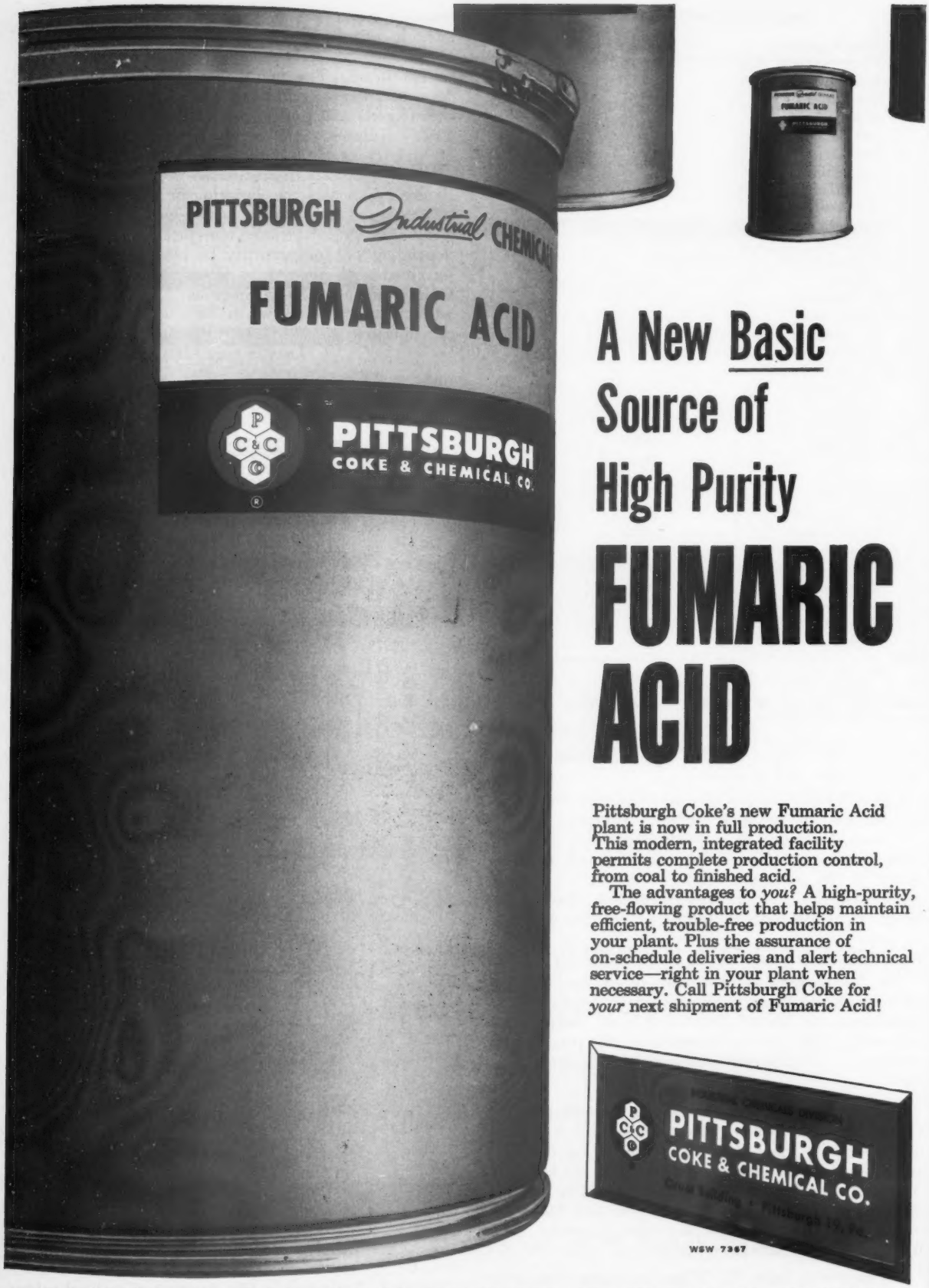


Figure 2. Variations in film hardness of cyclized rubber with type and quantity of plasticizer.



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Johns-Manville CELITE Diatomite Pigments

By
Phil Heiberger

The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

LITTLE did I suspect, when I jotted down a few facts about violin varnish a couple of months ago, that I had touched upon a subject of keen interest to many readers. Several were thoughtful enough to send me further information and some referred me to additional sources. Louis Weiner, of Fairlawn, New Jersey, wrote a letter rich in detail. I'm sure he won't mind my quoting a few lines.

P. Heiberger

One item of interest to Mr. Weiner "was a special high fidelity binaural broadcast on Oct. 15, 1955 by the WQXR String Quartet on New York Radio Station WQXR in which the violins of Guiseppe Virzi (a New York violin maker) were compared with those of Stradivarius. The same musical passages were played in an identical manner so that the listener first heard one instrument and then the other. Virzi's violins were claimed to be especially different because of an entirely new interior construnction of the instrument. He explained, during an interview on the program, that his instruments produce fuller and purer sound and superior tonal clarity by virtue of individual design and material consisting of strips and triangles of willow. What I actually heard on my less than hi-fi radio seemed to support the descriptions by the announcer and Mr. Virzi."

Of course we have always known that the varnish was not the sole factor influencing tonal quality, although I had inferred from various books and magazine articles that the violin construction patterns were considered to have been perfected and no further changes believed to be needed. Perhaps, however, application of modern acoustical knowledge may yet compensate for contemporary varnish deficiencies (if such there be.).

Consumers Union

Mr. Weiner referred me also to "an article in the March 1952 issue of *Consumers Union Reports* (Mt. Vernon, N. Y.) which deals with the stringed instruments including a short discussion of the making of a good instrument, purchasing advice and a listing of the best known names and the prices they command."

Dragon's Blood and Gamboge

In the January 1956 issue of *Coronet*, Mr. Weiner advised me, there's an article entitled "Stradivari of the Catskills," by Henry Morton Robinson, which relates the story of Harry Stoutenburgh, a contemporary violin maker of considerable renown who for five years was an apprentice of Simone Sacconi, one of the greatest living violin-makers.

Says Robinson, "No one claims that Harry Stoutenburgh's violins are the equal of the finest Strads. But, according to experts, a good Stoutenburgh compares favorably in tonal quality with the instruments of secondary European masters like Stainer and Vuillaume whose violins are prized by concert artists and higher-paid orchestra musicians."

"Stoutenburgh believes," Robinson states, "that the selection of wood is the most critical step in making a violin. That's why he roams the Catskill forests. . . . looking for a healthy red maple vibrant with curl.

"When he finds one that looks just right, he buys it from the owner and chops it down himself. Then he quarters it on the spot, hauls it away and sets it aside to season. No kiln-dried lumber for Harry. He won't touch chisel to wood until nature has aged it from five to ten years.

"Harry applies 12 coats of varnish to his instruments. Every coat is rubbed down by hand, after a two-week drying period in a dust free chamber. Like all luthiers, Harry keeps his varnish formula a secret, but admits that it is a combination of rare gums—dragon's blood and gamboge—blended with finest linseed.

"While waiting for the varnish to dry on one violin, Harry carves the neck, scroll or fingerboard of another. Thus four or five instruments are kept going at the same time. A year elapses before a violin is ready to be strung and tuned."

12 Coats in 7 Months

I noted that Stoutenburg applies 12 coats over a 7-month period, which agrees roughly with the old violin-makers. Yet, one reader assured me he knows a luthier who uses ordinary furniture lacquer.

Another reader, of Italian ancestry, stated that the Cremona climate is generally cold, humid and without sunshine!

Buy By Ear

Hi-fi, wedge-shaped bars, acoustic principles, Consumers Union, famous names, secret formulae, maple with curl, ordinary furniture lacquer, sunny Cremona, dragon's blood. Add them all up and what do you have? Now that I'm in the market for a viola for personal use, I must still resort to the time-honored custom: listen to as many as possible in my price bracket, then buy the one that sounds best, and hope it will continue to satisfy. More than that no man can do.

Qualitative Analysis

WHAT are scientists made of? Sugar and spice and *almost* everything nice, according to clinical psychologist Dr. Anne Roe. In "The Making of a Scientist," (published in 1952 by Dodd, Mead & Company) Dr. Roe has recorded the results of her four-year study of sixty-four of America's top scientists.

She found three outstanding characteristics shared by all. First, each had had in childhood close and influential contact with people (usually those at home; sometimes at school) who placed a high valuation on learning and on intellectual satisfactions for their own sake "in terms of enrichment of life, and not just for economic and social rewards." Second, each spent a large part of his time "thinking about things in a question-answering way." In other words, they were intensely curious. Third, each discovered early, many just by chance circumstances, that "they could satisfy their curiosity by their own efforts." Curiosity may often kill a cat, but curiosity unstultified is what makes a scientist.

"It is true, I think," states Dr. Roe, "that scientists are usually very good citizens—they mind their own business, they pay at least as much attention to civic duties as the average man does, they do not enrich themselves at others' expense, they and their families rarely become public charges, and the more violent crimes are practically unknown among them." You see? So far, "everything nice."

". . . . .on test material," she goes on to say, "they show up as an unaggressive group, on the whole."

Ah! There's the rub, and perhaps the nub of the whole problem discussed in the October 6, 1958 issue of *Chemical and Engineering News* under the Management headline, "No Surplus at the Top." According to this report, demand for capable executives with scientific or engineering experience still exceeds supply. The reason? Too few individuals have talents or interests in both scientific and administrative work, industrial officials claim. One is quoted as saying, "I find scientific and engineering personnel not primarily interested in leader roles. Further, they have difficulty making calculated risk decisions and delegating responsibility."

Other officials are quoted as follows: "The two qualities (technical ability and administrative ability) are to some extent incompatible, in my opinion." "I feel that any good scientific-technical person will have a somewhat difficult time in supervising personnel. Chemicals and machines can't talk back and have no emotions or feelings, but people do. The scientific mind often doesn't understand this fact." "Most good administrators with technical training don't have enough technical experience."

Some of these pessimistic remarks seem unanswerable until you sit back in your easy chair, clasp your hands on top of your head, close your eyes, furrow your brows, and indulge in a little quiet contemplation. Is there perhaps a faint touch of prejudice here? Is there a lack of understanding caused by corresponding lack of frank and frequent communication between members of the two groups? Maybe.

Of course a higher incidence of certain traits will be found in one group while a higher incidence of other traits will be found in another. But surprisingly often the twain shall meet. Much depends upon background and training. Leadership and all that it implies can be carefully fostered or thoughtlessly squelched at every age and at every level. This is true not only of scientific personnel but of all kinds of people everywhere. And one of the ways of squelching leadership is through overspecialization. The man who is concentrating on learning more and more about less and less is definitely not on the high road to the full development of his latent executive abilities.

This poses a major problem in our democracy today, not at all confined to scientific endeavors. On all sides you hear a hue and cry over the dearth of qualified leadership—in politics, in the ministry, in youth activities, to mention just a few areas. Scientists are not the only ones up for criticism.

As always, there's a bright side to this picture. Our colleges and universities are aware of the problem and are doing their utmost to deal with it effectively. Spokesmen have lately been stressing the leadership training aspects of education and the obligations of colleges and universities toward their students. A good case in point is Dean W. Malott, president of Cornell University, some of whose remarks on this subject I would like to quote. They appeared in his annual report for the year 1957-1958.

"There are those among us today who urge that we. . . . .follow the Communist example and give greater emphasis to the teaching of science, not in its broadest, enriching sense, but in a narrow, data-finding concept devoid of those element and influences designed for the development of the man who has chosen to labor in the vineyards of science."

"We must keep our perspective and. . . . .continue to aid our students to see things in the perspective of a free society. Depth of specialization may result in a narrowness of intellect and spirit, if we are not alert to this danger. . . Our concern is not only with the scientist, the business man, the professional man, the academician, but more importantly with the man who is a scientist, the man who is in business, the man who follows a professional career, and the man who is a scholar."

"In every division of this University full recognition must exist of our role as nurturers of those qualities among young people which make for effective leadership."

"Our faculty is doing a yeoman task. . . . .in discovering and cultivating potentials for leadership among (our students)."

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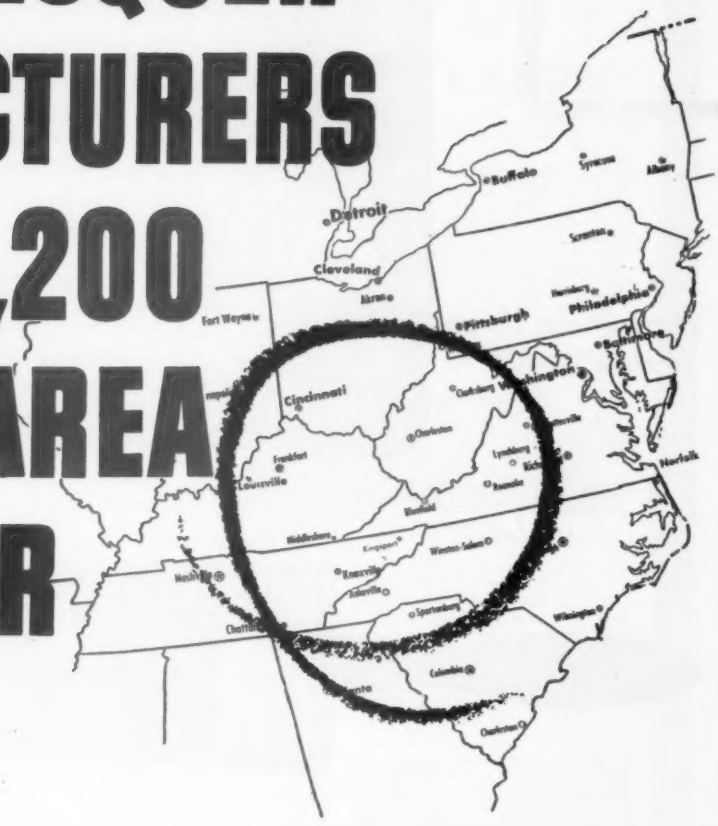

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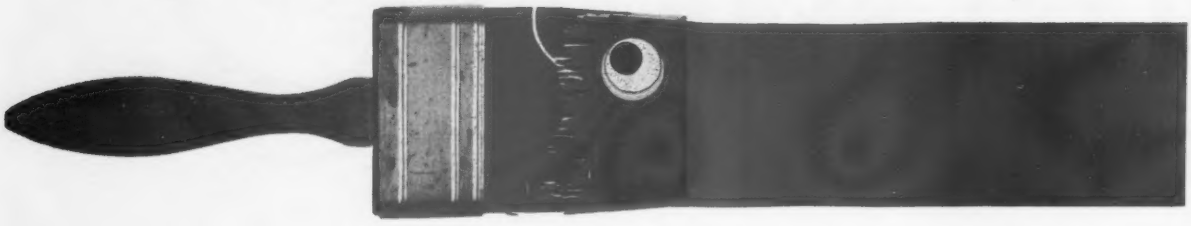
How about these "cold weather" paints?

I hear they're based on Lytron 680 Latex*



Lytron* 680

can produce smooth clear films, without modification, down as low as 40°F!

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Other "thankful" features include excellent adhesion, even over glossy surfaces, which results from the controlled small particle size of this chemically unique acrylic-type interpolymer. This also assures proper binding of high volumes of pigment, superior color retention, greater stability. Painters also admire the ease of application over porous or sealed surfaces. No spotting or color mottling, no ruptures, minimum blistering even over green masonry. Water resistance within 30 minutes. Fast drying rate, easy clean-up.

SPECIAL NOTE TO MANUFACTURERS OF INTERIOR PAINTS: Although Lytron 680 was developed as a binder for exterior paints, features have been incorporated which make it equally useful as a sole vehicle or as a modifier of other alkaline latex vehicles in high quality interior paints. Small quantities of Lytron 680 added to alkyd or styrene butadiene systems can improve dryability, adhesion, durability, flexibility. Be sure to investigate this low-cost way to gain the superior properties of Lytron 680. For further information on Lytron 680, write Monsanto Chemical Company, Surface Coating Resins Dept., Springfield 2, Mass.

Other Monsanto products for the surface coating industry include Amino Resins, Phenolic Resins, and Styrene Latices and Resins.

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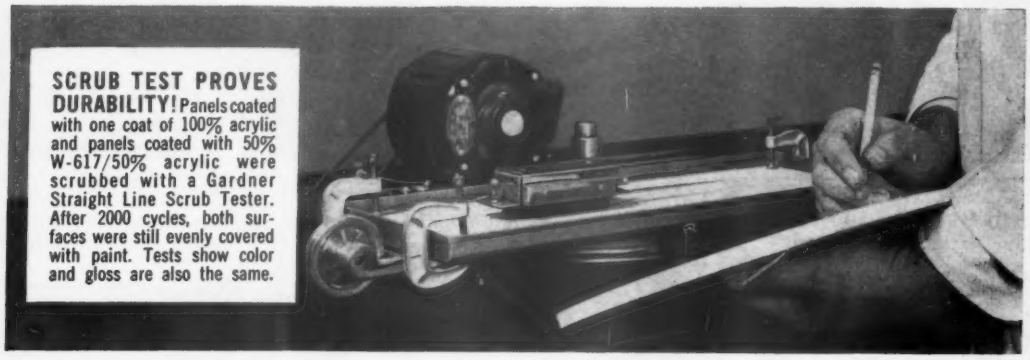

SCRUB TEST PROVES DURABILITY! Panels coated with one coat of 100% acrylic and panels coated with 50% W-617/50% acrylic were scrubbed with a Gardner Straight Line Scrub Tester. After 2000 cycles, both surfaces were still evenly covered with paint. Tests show color and gloss are also the same.

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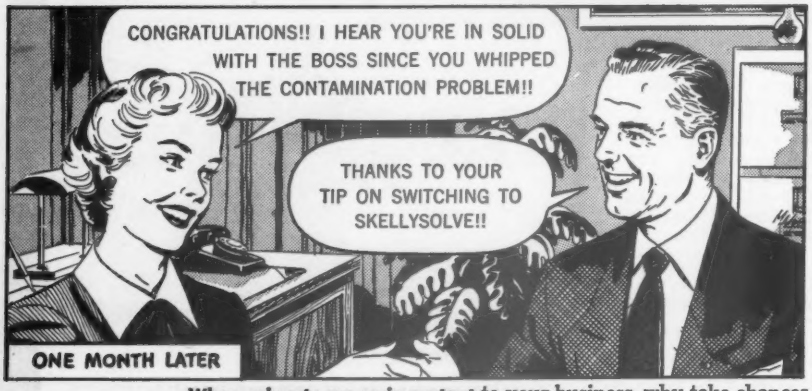
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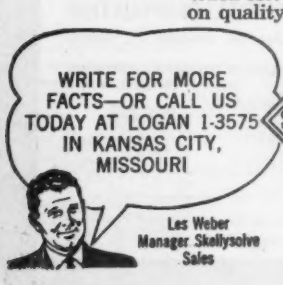

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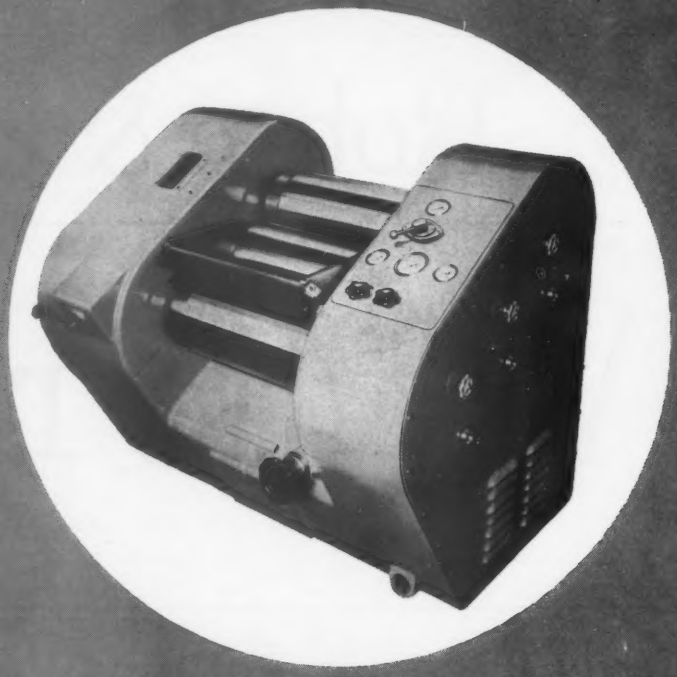

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Close control of batch cooking is essential in producing resins. Here a large batch-cooking kettle employs cluster of radiant burners to obtain rapid and uniform heat. For details see page 59.

Weatherproof your paint with **Minnesota** Linseed Oil!

Wherever the wind whips in under lashing rain, blistering sun or rasping blizzard—wherever there's weather, Minnesota Linseed Oil has proven itself. It's tried and true, the time-tested vehicle for outside house paint that is still the best. There is no acceptable substitute. In purity, quality control and dependability, the Minnesota brand is a linseed oil with a significant history. Ask your nearest sales representative . . . your paint will be the better for it.

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Gradient Heat System—

Controls Batch Cooking of Resins

SPECIALISTS in the manufacture of synthetic resins, the C. J. Osborn Company has overcome a production problem that has faced their industry for many years—how to provide speed of heating combined with uniformity of heat application and precision control. Flexibility of heating, to meet varying processing needs, is a "must" for the successful production of wrinkle-finish and other specialty coating vehicles.

The heating problem was solved with a specially designed Gradiation system furnished by Selas Corporation of America, Dresher, Pa. Since its installation, production of vehicles in any quantity (from as small as five drum batches up to 45 drum batches) can be handled readily on any given run . . . heat release from a burner cluster can be automatically throttled over a turndown ratio of 15:1.

Control of Viscosity Critical

Close control of the company's entire production cycle, to synchronize heating and testing, is also a must. It entails frequent sampling of synthetic resin batches for continuous "control" tests during manufacture, and precise application of heat in accordance with the results of these tests. Only by "walking a resin solution through" can the critical point of viscosity be approached safely.

This is why a laboratory-type operation is employed from product development through production and each separate processing step carefully regulated. It is why Gradiation heating, which provides a high temperature differential between heat source and workpiece, must be used for the ultimate in fast, uniform and controllable cooking temperatures.

Gas-Air Mixture Burned

The Gradiation heating system involves the use of Duradiant burner settings, a typical example of which is shown in Fig. I. The burners create radiant heat by burning closely-controlled gas-air mixtures against special cup-shaped refractory surfaces. Heated to incandescence, the cup surfaces, in turn, beam radiant heat to the kettles at the speed of light. (Fig. 2 is a different type of Duradiant burner than those shown in Fig. 1, but the heating principle is the same.)

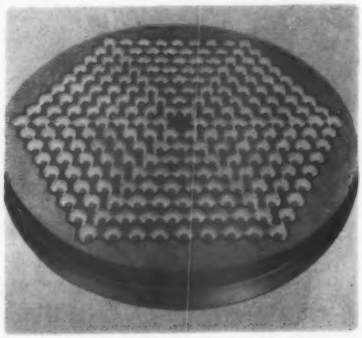


Figure 1. Typical cluster arrangement of Duradiant burners in batch-cooking furnace provides uniform temperature on bottom of process vessel, uniform heating of batch material. Fuel input to each group is controlled separately.

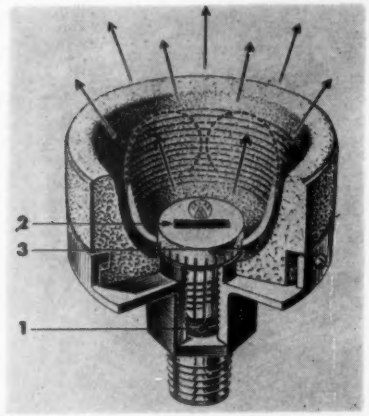


Figure 2. Schematic diagram of Duradiant burner operation. Gas-air mixture enters mixture tube (1); proceeds to burner tip (2); passes through tip, is distributed radially, and burns within refractory cup (3). Inner contour of cup is shaped so surface is always "washed" by hot combustion products and heated to incandescence.

The overall speed in heating of batches is achieved by a combination of this unsurpassed rate of heat transfer, the high temperature gradient attained, and close proximity of kettles to the heat source. Such proximity is safe because the burners have no harmful flame impingement, combustion being completed entirely within the cup.

The system responds readily to automatic control and has proved thoroughly dependable in duplication of batch quality, precise in its adherence to pre-determined heating rates. Desired temperatures at Osborn can be held within a few degrees of control point, which is extremely important as these are set kettles and cannot be moved from the fire. The clusters of burners also distribute the heat uniformly to the bottoms of the kettles without any spot overheating that would cause premature kettle failure and carburization, or discoloration of batch material.

Since heat is both generated and absorbed directly under the kettle, the need for auxiliary heat transfer

This article is based on work conducted by C. F. Silleck, technical director of the C. J. Osborn Co., Linden, N. J.

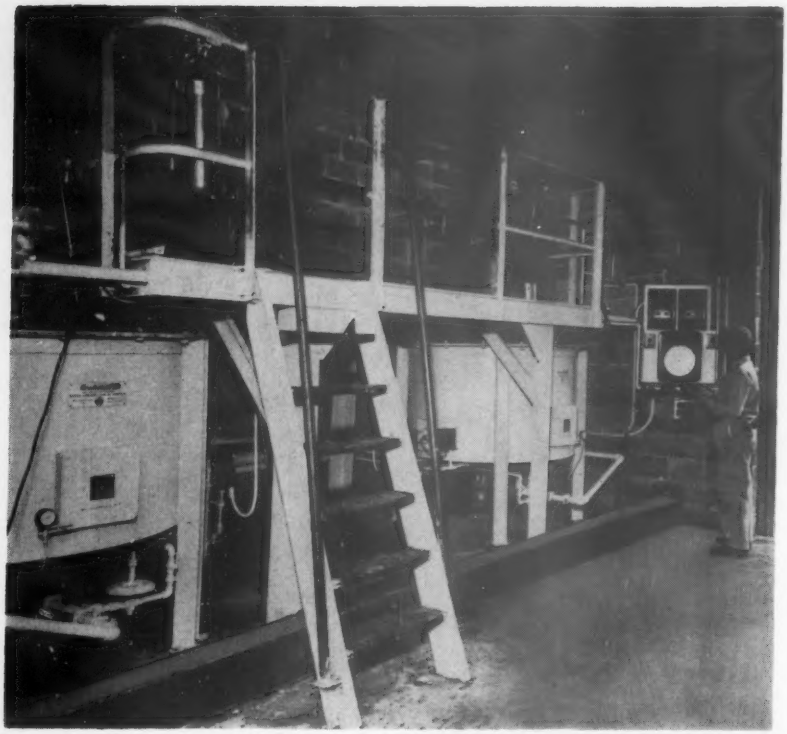
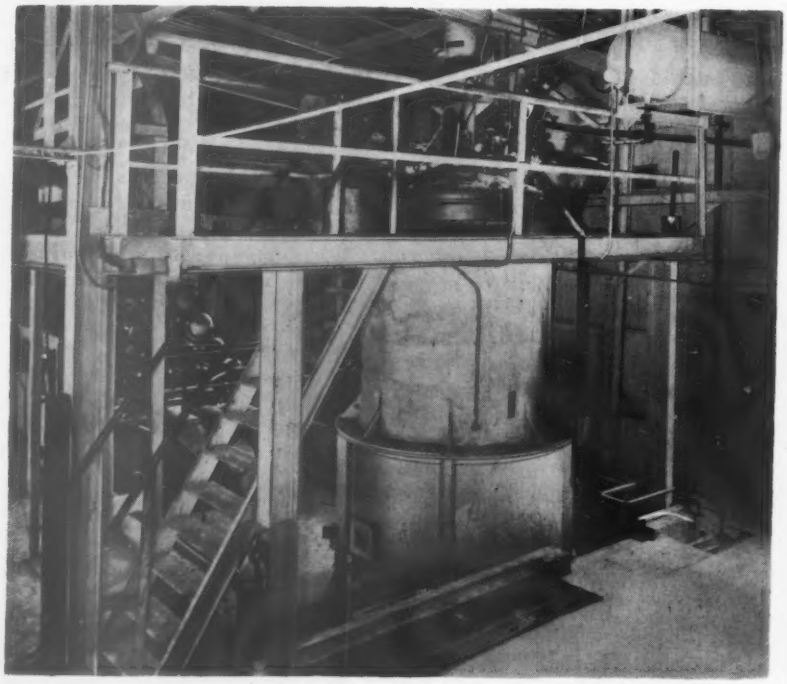


Figure 3. Two process vessels, installed at Osborn for pilot and production runs of coating vehicles, utilize enclosed, gas-fired settings. High turndown ratio permits processing of both small and large batches. Operator here is logging temperature of resin batch during production cycle.

Figure 4. Large batch-cooking kettle, used in production of coating-vehicles, employs cluster of radiant burners. Ability to apply heat rapidly and uniformly permits great versatility in processing specialty resins.



space, with remote and costly generating facilities, has been eliminated. The individual kettles Osborn uses are operated at different temperatures, as needed, without dependence upon a central heating system.

Pilot-Size Runs

A closer look at the Osborn Company's manufacturing processes shows why such precise heating and operating methods are more than necessary.

Initially, every new product developed in the laboratory is cooked in five-drum lots in a pilot kettle (two are shown in Fig. 3). It is put through an arbitrary processing schedule to determine critical points in the operation that may not have been discovered in the laboratory. The pilot kettles can be used interchangeably for pilot and production runs because of the precise control of heat input possible for any size charge from five to 20 drums.

Several larger batches are then produced in the pilot kettles, using the preliminary data obtained in the initial run. From these results the exact heating cycle is set up. Once the time-temperature relationship has been determined, batches can be produced in any size in the pilot kettles up to 20 drums.

In the same way, the largest kettle (Fig. 4) can be used for any size batch—from as small as 15 drums to a full capacity of approximately 50 drums—with heat input correctly proportioned and accurately controlled.

This accuracy of temperature control, the importance of which cannot be over-stressed, is clearly evidenced by the Cooking Log Chart shown in Fig. 5. The curve from A to B represents upheat prior to melting certain ingredients; dip at B indicates solids melting; B to C is upheat at control rate, after all ingredients are melted; C to D is a holding period of 1-hr. at 180°C (356°F); D to E is upheat

Figure 5. **Chart, recorded by instrument shown in Fig. 3, is cooking log for one of Osborn's specialty coating vehicles. The curve from E to F is of special interest, as it represents a 12½ hr. holding period during which temperature did not vary more than two or three degrees.**

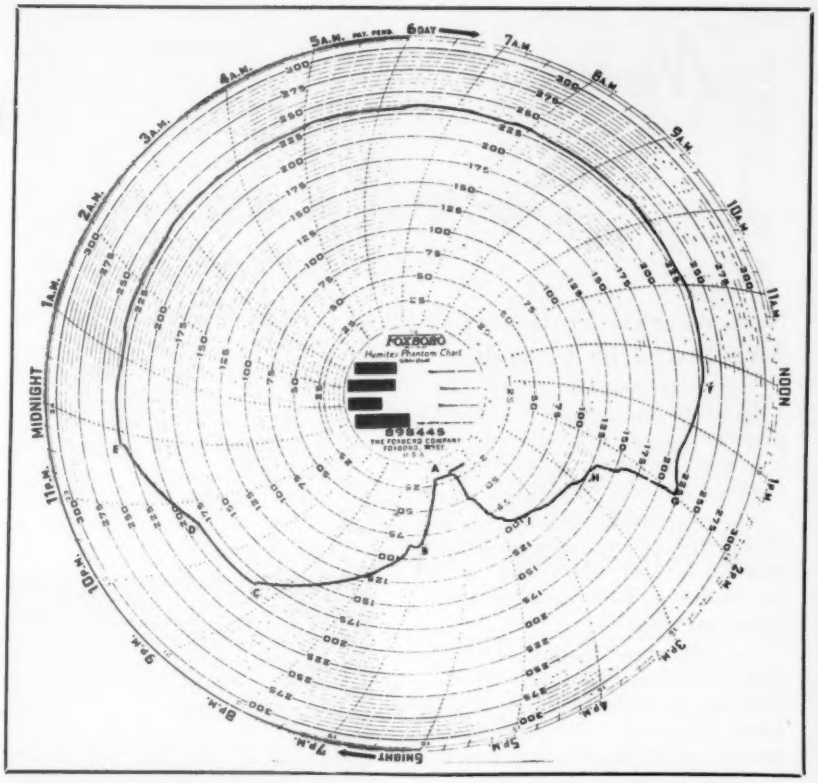
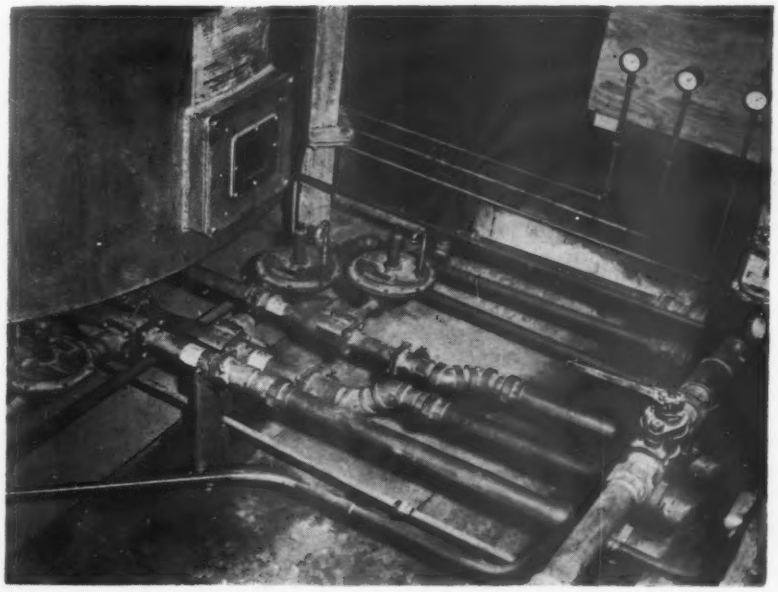


Figure 6. **Triple manifolding groups of burners in this large kettle permits all, or a portion, to be modulated and/or turned off at will. Similar manifolding is also used on the smaller process vessels shown in Fig. 3. Air from largest pipe (lower right), passing gas lines, inspirates gas in proper proportions for mixing. Gas pressure in each line is maintained by pressure regulators shown.**



to 230°C (446°F); E to F is a 12½ hour holding period, during which the temperature does not vary more than two or three degrees; F to G is a cooling period without use of water and with burners turned off; G to H is the water cooling period; at H a solvent is added to begin the solution operation.

A wide range of control, also of prime importance, is attained by the design features of the Duradiant burner and triple manifolding of the groups of burners. As a result, all, or a portion, can be modulated and/or turned off at will. (See Fig. 6). The turndown ratio of the entire cluster is a multiple of the ratios of the separate rings. Cumulative ratio is so high that heat input can be properly held low enough in a pilot kettle to process a five-drum test batch, then high enough on successive runs to handle a full capacity production run of 20 drums.

Testing During Processing

Samples of resin batches under heat are sometimes taken as often as every 10 or 15 min. during preliminary processing, as well as during critical production stages, and tested for viscosity and acidity.

After completion of a batch, the material is thinned, filtered and the final product tested for solids content of the resin solution, acid number, color and viscosity. For hard resins, the softening point is determined during heating and after processing.

All tests are effective tests, the results of which are able to be applied immediately to processing because of the fine degree of temperature control. Any temperature corrections indicated by test results, even the most minute, are made accurately and quickly.

The company performs still one

(*Turn to page 72*)

New Developments

New Wrinkle Finishes Announced by Carbide

The development of the first wrinkle finishes based on vinyl plastisols, organosols and solutions has been announced by Union Carbide Plastics Company.

The new finishes provide unique decorative effects as well as the resistance and durability characteristics of Bakelite vinyl resin-based coatings.

An important ingredient in the new finishes is Monomer MG-1, a product of Union Carbide Chemicals Company. In addition to a select combination of driers and polymerization catalysts, Monomer MG-1 is largely responsible for the development of the wrinkle pattern. The polymerizable plasticizer is also familiar as a plastisol modifier used to produce extremely rigid type plastisols.

Plastisols:

For maximum thickness wrinkle coatings, plastisols are preferred. The particular advantages of plastisols for wrinkle finishes are:

1. Freedom from objectionable volatiles.
2. Application of 100% solids content for maximum film build.
3. Excellent flexibility of films.
4. Film toughness.
5. Ease of preparation.
6. Films are non-critical as to wrinkle uniformity.

Vinyl wrinkle formulated with MG-1. Magnification: 19X.

Conventional alkyd wrinkle. Magnification: 19X.

Generally these plastisols may be sprayed to a film thickness of five to ten mils per wet coat.

Organosols:

Where the use of volatiles is not objectionable and lower viscosity coatings are desired, organosols may be used instead of plastisols for wrinkle finishes. The main advantages of organosols are:

1. Greater range of film hardness.
2. Easier handling with spray equipment because of lower viscosity.
3. Lower viscosities give higher pigmentation and greater range of modifiers.
4. Thinner films.
5. Greater range of film flexibility and hardness.

Conventional enamel or lacquer guns may be used to spray organosol wrinkle finish. Except for the difference in advantages listed above, wrinkle finishes made from organosols are similar in properties to those made from plastisols because the same type Bakelite vinyl-based resin is used. A typical formulation is given in Table I.

Solution Coatings:

The major advantage of solution coatings is that finishes may be prepared using lower temperatures in the baking schedule than is possible with either plastisols or organosols. In formulation, solution vinyl wrinkle coatings are quite different from plastisols and organosols. The solution coating closely follows the principles of general solution vinyl coating formulation.

Yellow Organosol Wrinkle Finish Formulation

	Parts by Weight
Bakelite Vinyl Resin QYNV	40.0
Bakelite Vinyl Resin VYHH	10.0
Monomer MG-1	35.0
CW-2015 Catalyst—Linde Co.	2.3
Cobalt Octoate (6% N.V.)- Nuodex	0.6
Stabilizer D-22	0.5
Bakelite Epoxy Resin ERL-2774	0.5
"TiO_2" Pigment Paste, 50% in Flexol Dop	4.0
Chrome Yellow Pigment Paste, 60% in Flexol Dop	8.0
Diisobutyl Ketone	12.0
"Solvesso" No. 100	48.0
Methyl Cellosolve	10.0
Toluene	30.0

Mixing Procedure

(for "Hobart" or similar mixer)

1. Resin QYNV ground with the diisobutyl ketone/"Solvesso" No. 100 in ball mill for 16 hours.
2. Resin VYHH dissolved into the methyl Cellosolve/toluene solvent mixture.
3. The VYHH solution is added to the pigment pastes with agitation. The QYNV grind is then added to this mixture with agitation.
4. Stabilizers, monomer MG-1, catalyst and drier are then added, also with agitation.

Table I.

Weighing Attachment Offered by Clark

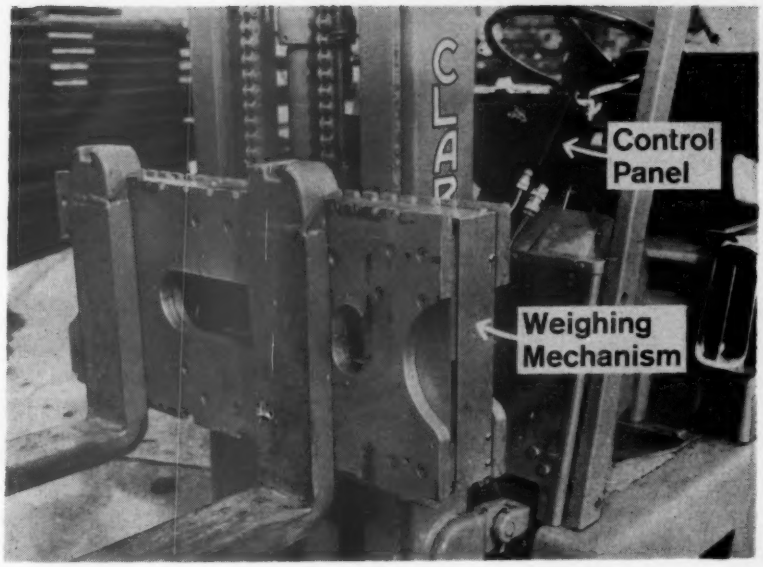
A 5000 lb. capacity weighing attachment for fork-lift trucks, accurate to two-tenths of one per cent of its capacity, is now available on the 3000, 4000 and 5000 lb. "Clarklift" model trucks manufactured by the Industrial Truck Division of Clark Equipment Company.

According to Clark, the high degree of accuracy of the weighing device makes it practical for such applications as checkweighing receivables, weighing intra-plant shipments, inventory control by weight, batch process weighing and checkweighing freight shipments. Use of a lift truck mounted weighing attachment reduces travel and eliminates frequent pick-ups and set-downs required when floor scales are used.

Controls for the device, including weight indicator, are mounted on the lift truck steering column within fingertip reach of the operator. The weighing mechanism is mounted between upright and fork plate. There are no mechanical linkages, knife edges or moving parts in the weighing mechanism. Accuracy of weight measurement is not effected by position of load, even when load is carried on one fork.

Developed jointly by Clark and Baldwin-Lima-Hamilton Corporation, the unit utilizes a steel column rather than a spring to support load being weighed. Weight of the load is applied to a steel column in a load cell. The resulting compression is sensed by a strain gage and translated into pound readings on the instrument panel. A zeroing out control permits the operator to discount weight of pallets or containers if only net weight of the load is desired. Circuitry of the device utilizes transistors and condensers and is designed for rugged industrial use. Overload stops protect the system from severe shocks.

Detailed information on the Baldwin-Clark weighing attachment may be obtained by writing Industrial Truck Division, Clark Equipment Company, Dept. PVP, Battle Creek, Mich.



New Baldwin-Clark weighing attachment for "Clarklift" Fork Trucks.

Metal Painting Method Developed by Du Pont

Development of a safer, faster, and more economical technique for cleaning and painting metal parts has been announced by the Du Pont Electrochemicals Department at the National Metal Exposition and Congress.

By integrating vapor degreasing with application of paint by flow coating, the new process sharply reduces initial investment, operating costs, and floor space requirements compared to present methods of operation. By using the same solvent—nonflammable trichlorethylene — for vapor degreasing and paint thinner, savings inherent in flow coating methods are realized, and flammability hazards eliminated.

Savings of as much as 50 per cent in initial investment and operating cost are possible by use of the trichlorethylene-based system, according to Du Pont's Fred G. Schumacher, who is coordinating the program. Principal savings result from the recovery of over-sprayed paint and volatile thinner. Important economies in labor and utilities costs also are effected by combining cleaning, painting, and drying steps in a single machine. All operations are carried out beneath a protective "blanket" of trichlorethylene vapor. Work enters at one end, is cleaned, painted, and removed from the machine free of trichlorethylene thinner.

When an air drying paint is used, the parts are dry and ready for shipment when removed, since evaporation of the thinner occurs instantly as the part leaves the machine throat. When a baking paint is used, the parts proceed immediately to the baking operation. Where a second coat of paint is desired, in some instances it can be applied prior to baking the primer, and the two coats baked together.

Du Pont tests show that trichlorethylene-thinned paints with properties similar to those of most conventional paints can be formulated. In general, any paint ingredient which is soluble in trichlorethylene, such as certain alkyd resins, epoxy esters, acrylic resins, asphaltic materials, chlorinated rubbers, etc., can be used in compounding trichlorethylene-thinned paints. Paint can be pigmented, and may be decorative as well as protective in nature.

Present machinery was designed for automated production line use, but can be adapted easily for other types of operations, including dip painting instead of flow coating.

Details of the new process are available from the Du Pont Electrochemicals Department, Dept. PVP, Wilmington 98, Del.

AZO Leaded ZINC OXIDES

meet exact requirements of paint industry

Paint manufacturers in increasing numbers are using economical leaded zinc oxides in their exterior paints. To meet this growing demand, a number of AZO leaded zinc oxides have been developed, and are immediately available.

In addition, we are prepared to produce oxides of any lead content and consistency to meet the requirements of special formulas. You can be sure of the right leaded zinc oxide for your product when you specify AZO.

CO-FUMED TYPE LEADED ZINC OXIDES

AZO 35-L. 35% leaded zinc oxide of low consistency.

AZO 50-L. 50% leaded zinc, low consistency.

AZO 18-L. Highly basic, low consistency type.

All co-fumed leaded zinc oxides are easily mixed and incorporated in paint vehicles.

BLENDED TYPE LEADED ZINC OXIDES

AZO 20-B. Acicular type of 20% leaded zinc oxide. Excellent color, medium consistency.

AZO 35-M. Acicular type of 35% leaded zinc oxide. Excellent color, medium consistency.

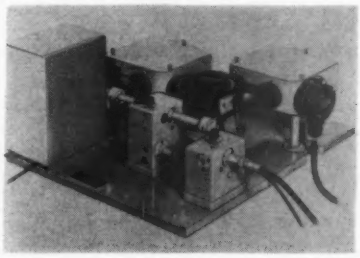
Blended type leaded zinc oxides generally give higher consistency (or oil absorption) and improve the color of the product.

American Zinc sales company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY
COLUMBUS, OHIO • CHICAGO • ST. LOUIS • NEW YORK

NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



FERRAND

SPECTROFLUOROMETER
Two New Types

In addition to the firm's standard spectrofluorometer, two new types of spectrofluorometers are now available.

One is a dual-purpose instrument for spectrofluorometric transmission measurements in the spectral region from 220 to 650 mu.

The second is a triple-purpose instrument which can be utilized as a spectrofluorometer, spectrophotometer or for reflectance measurements of solid samples such as textiles, plastics, paints, paper, powders, etc.

Farrand Optical Co., Inc., Dept. PH-4, PVP, Bronx Blvd. & East 238th Street, New York 70, N. Y.

ACRYLIC RESIN
For Metal Coatings

Acryloid A-21, said to be a clear, colorless, rapidly drying, hard polymer solution developed for use in automotive finishes and other metal coatings.

Outstanding among the properties of this acrylic resin is its adhesion to many different surfaces. Acryloid A-21 adheres firmly when formulated as either an air-drying or baking top coat on bare metal or commercial primers for automobiles and appliances.

Durability under extremes of sunshine, humidity and low temperature is another notable feature of coatings made with this acrylic polymer. Wider ranges of colors are now possible for plastics, automotive, metal, wood and fabric coatings because Acryloid A-21 is claimed to provide excellent dispersion with pigments and metallic powders in various combinations. Infrequent polishing is required to maintain the high lustre of these acrylic lacquer finishes.

Resinous Products Division, Rohm & Haas Company, Dept. PVP Washington Square, Philadelphia 5, Pa.

DEWEY & ALMY

VINYL GELLED PAINT
Non-Drip

A formulation for a water base vinyl gelled paint which refuses to drip from brush or roller.

The new formulation, a white interior gelled paint, is based on the firm's Everflex GT vinyl acetate copolymer.

The thixotropic paint has a stiff consistency in the can but flows smoothly onto surfaces in a coat scarcely thicker than a conventional latex paint.

Gelled paint is said to also eliminate the fear of tipping over the paint can that inhibits many do-it-yourselfers. Vinyl-based gelled paints flow out of the can very slowly, if at all.

Dewey & Almy Chemical Division, W. R. Grace & Co., Dept. PVP, 62 Whittemore Ave., Cambridge 40, Mass.

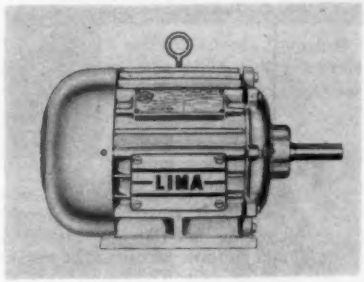
EXPLOSION-PROOF MOTOR
One to Forty HP

EX explosion-proof motors incorporating the latest technical advances, are Underwriters' Laboratories Approved for Class I Group D and Class II Groups F and G Service.

Frame assignments accommodate standard ratings of 1 through 40 HP, either 3 or 2 phase, in all commercial frequencies and voltages below 600.

Approved for use in locations where hazardous gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors and natural gas are present.

EX motor frames incorporate deep, integrally cast fins that provide extra cooling surface for rapid heat dissipation. Design eliminates all corners, pockets and air passages which could become clogged and retard cooling and motor efficiency. A specially designed external fan forces air at high velocity over the outside of the motor to provide constant cooling and a self-cleaning action.



LIMA

The Lima Electric Motor Co., Inc., Mr. C. D. Byran, Sales Promotion Manager, Dept. 314, PVP, Lima, Ohio.

CURING AGENTS
For Epoxy Resins

Longer pot life and low volatility

are said to be among the advantages of three new dicarboxylic anhydride hardeners for epoxy resins.

The new anhydrides, Dodecenyl Succinic, Methyl Nadic (R) and Hexahydrophthalic, provide benefits when used for laminating compositions, potting, encapsulating, and impregnating electrical components. They are also claimed to be superior to previous curing agents in the preparation of tools and dies and industrial baked coatings.

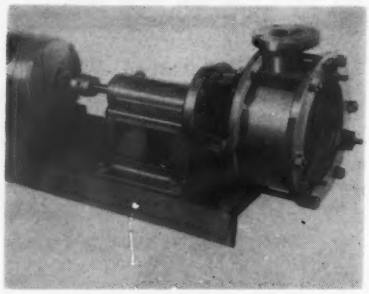
New anhydride hardeners impart long pot life to the resin mixtures, blend easily with both solid and liquid epoxy and give low-peak exotherms and low viscosity to room temperature mixtures. They also produce resins with physical properties superior to amine cured systems and provide cured resins of very low weight-loss at elevated temperatures.

National Aniline Division, Dept. PVP, 40 Rector Street, New York 6, N. Y.

CENTRIFUGAL PUMP
All-Plastic

New line of all-pastic PVC centrifugal pumps now available.

Pumps are constructed with all wetted parts of unplasticized, unmodified polyvinyl chloride, offering the broadest possible range of chemical resistance as well as the non-contaminating transfer of sensitive solutions. Available in four pump sizes, these units offer capacities from 10 to 180 GPM with discharge heads to 100 ft. Solution temperatures to 140°F can be handled.



VANTON

The heavy sectioned PVC casing is totally protected by a cast iron frame giving rigid support. The impellers are molded and are of a dynamically balanced design. Vanes are contoured to offer maximum efficiency.

All PVC centrifugals are equipped with mechanical shaft seals of the latest design which are available in a range of materials to cover virtually all corrosive applications.

Unit is so designed that stationary rings can be reversed for additional use after long periods of service.

Simplicity of maintenance is also featured in this new line. By removing just six bolts, the casing may be opened and the impeller inspected or replaced without breakdown of the entire pump. The heavy duty shaft, constructed of stainless steel with a PVC cover on the wetted end, can be removed from the pump from either direction.

Vanton Pump & Equipment Co., Dept. PVP, Hillside, N. J.

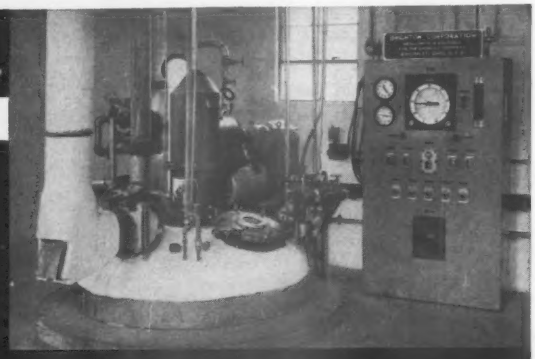
PHTHALOCYANINE BLUE
New Green Shade

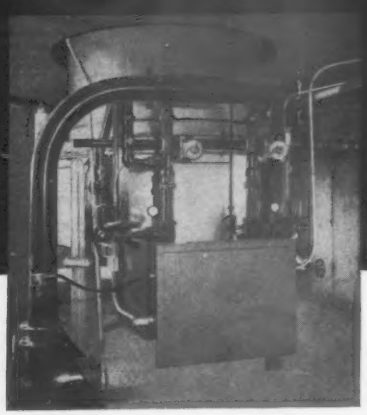
A new green shade, non-crystallizing, non-flocculating type phthalocyanine blue, called Solfast Blue G-NCNF 43100, has recently been developed.

This strong new pigment is said to have exceptionally jet masstone and bright greenish undertone.

From deep shades to delicate pastels, the brightness of 43100 is useful as a primary pigment or

better synthetics . . .
LOWER COSTS
closer inventory control with
BRIGHTON RESIN KETTLE REACTOR





Installation
The Foy Paint Co.
Cincinnati 12, Ohio

Synthetic resin manufacturing costs can be reduced when these products are prepared in a gas fired Brighton Kettle Reactor. Actual operation charts prove less cooking time through heat radiation to produce clearer alkyds with a better quality and uniform viscosity. The Brighton Kettle, adaptable to Solvent or Fusion cooking, is automatic. You evaluate the product, control production and inventory.

For profitable processing depend on Brighton equipment, the results of creative engineering that can best serve your industry.

Write for complete information. Prompt attention to all inquiries.

BRIGHTON
METALSMITHS EST. 1914
CORPORATION
820 STATE AVENUE · CINCINNATI 4, OHIO

mixed with yellows to make cleaner greens. Solfast Blue G 43100 has excellent dispersion properties. It has been developed to obtain the ultimate in resistance to flocculation and crystal growth in aromatic solvents. This is shown by accelerated aging as well as room temperature tests.

Pigment, Color and Chemical Division, Sherwin-Williams Company, Dept. PVP, 260 Madison Avenue, New York 16, New York.

CRATE HANDLING DEVICE
Palletless Handling

A crate handling attachment made to perform two separate functions: one, handling equipment in cardboard cartons and the other handling equipment in cardboard wire bound crates with capacities up to 1500 lbs. has been developed.

With this attachment, cartoned material can be loaded, unloaded, transported and stacked without the use of pallets, forks or dunnage.

LEWIS-SHEPARD

For handling cartons, a beveled angle at the top of the frame of the attachment fits under the folded-over cover of the carton. The side of the carton adjacent to the truck rests against a wood backing plate.

For handling open wire-bound crates, the attachment is equipped with two hooks which engage the crate under its top board. The hooks are adjustable both in width and height to fit practically any sized crate. The hooks swing out of the way when cartons are being handled.

Handling device is quickly detachable. It is hung on the truck carriage and is readily interchangeable with standard forks. The lifting hooks are quickly adjustable for most conventional width or height crate or cartons. Can be made specially in tandem to handle as many as four appliances at once. The open frame construction affords the operator optimum visibility.

Lewis-Shepard Products, Inc., Dept. R8-29, PVP, 125 Walnut St., Watertown 72, Mass.

GREASE
Resists Fuels & Solvents

New type grease highly resistant to most fuels and solvents. Solvent resistant grease is said to be impervious to the washing action of a wide range of petroleum, coal tar and chlorinated liquids.

According to the manufacturer, the new grease permits normal lubrication of pumps, bearings and sliding surfaces that must work in the presence of solvents and liquid fuels.

Pennsylvania Refining Co., Dept. PVP, 2686 Lisbon Rd., Cleveland 4, Ohio.

ACRYLIC-VINYL LATEX
Low Particle Size

New product, called Cofar, is designed to embody the better characteristics of the acrylic and polyvinyl acetate systems.

PF-5 *Combination*
5-GALLON AND 1-GALLON
FILLING
AND
SEALING
MACHINE

The AMBROSE PF-5 is the newest combination five-gallon and one-gallon Filling and Sealing Machine on the market!

AIR POWERED
●
FIRE HAZARD REDUCED TO A MINIMUM
●
GEARLESS
Few Metal-to-Metal parts
●
REQUIRES ONLY 60 LBS. OF FREE AIR PRESSURE FOR ITS PUMP-TO-PAIL OPERATION

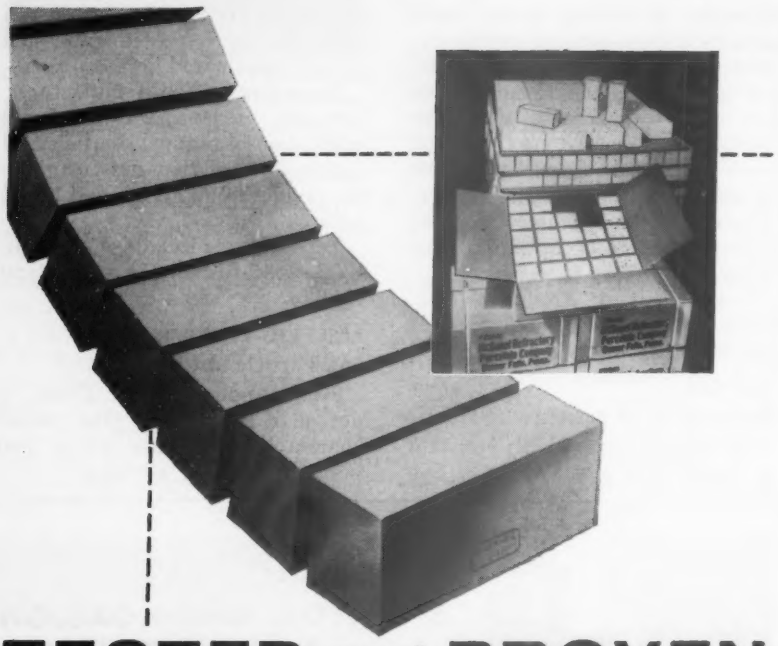
Combines economy with simplicity of construction. Fills and seals at speeds from 6 to 8 five-gallon pails per minute; fills and seals one-gallon pails at speeds from 14 to 16 containers per minute; depending upon viscosity of product, with accuracy to the drop!

This new machine is a time saver and a money saver. Its absolute accuracy in filling means savings in product overfilling. The PF-5 eliminates old fashion operations.

Delivers clean package. Fills ANY product that flows readily–light or heavy liquids.

No more outmoded sealing operations

C. M. AMBROSE CO.



TESTED and PROVEN

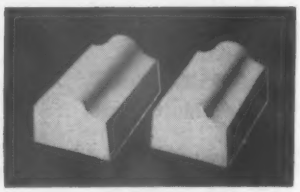
McDANEL

High Density Brick
Lasts at Least 3 Times Longer
Than Ordinary Brick!

McDANEL High Density Mill Lining Bricks set the standard for quality. They wear three times longer than standard density brick and at much lower cost. Relining one-third as often means large additional savings. McDanel bricks are continually quality controlled during manufacturing process and individually inspected before shipment. Wearing qualities are constantly checked in production work in our own mills. Proven by complete customer satisfaction during the past five years. Available in 1½ , 2", and 2½" thicknesses for all sizes of pebble mills.

McDANEL Lifter Bars
Made of High Density Body

McDanel Lifter Bars have scientifically designed contour to aid in cascading ball charge for more efficient grinding action and longer life.



McDANEL Industrial CERAMICS
1959-OUR 40th ANNIVERSARY

McDANEL
REFRACTORY PORCELAIN COMPANY
BEAVER FALLS · PENNSYLVANIA

NEW MATERIALS — EQUIPMENT

Claimed to be an ideal vehicle for primer-sealers, interior paints, exterior brick, cinder block, and masonry coatings.

Because of its low particle size, high quality paints can be made at high pigment volume concentrations.

Properly formulated Cofar paints said to show no pH drift on aging. Outstanding sheen, even on surfaces of varying porosity, is claimed.

Farnow Inc., Dept. PVP, 4-83 48th Ave., Long Island City 1, N. Y.

LIGHT ABSORBER
Ultraviolet Protection

Transforming transparent plastic films and surface coatings into ultraviolet opaque screens is a solution to the problem of ultraviolet degradation of organic materials. The newest commercial product that is said to provide this screening type of ultraviolet protection is Cyasorb UV 24 light absorber (2.2′ - dihydroxy - 4 - methoxybenzophenone).

Its effectiveness is greatest in the lower end of the sunlight spectrum (300-380 millimicrons). Cyasorb UV 24, however, does absorb partially in usable concentrations in the 380-400 millimicron range.

Its absorptive characteristics are especially important in such plastic applications as thin, transparent films and surface coatings. Films and coatings containing Cyasorb UV 24 are opaque to ultraviolet light.

In plastic applications where it is impractical to use an ultraviolet opaque screen, Cyasorb UV 24 can be incorporated into the bulk of the plastic.

American Cyanamid Co., Dept. PVP, 30 Rockefeller Plaza, New York 20, N. Y.

COLOR METER
Digital-Dial

A precise, digital-dial Color and Color-Difference meter has been developed.

The new instrument is intended primarily for small color differences found in the paint and plastics industries. It employs tristimulus filters and vacuum phototubes

which are thermostatted for maximum stability. The analog scales of the instrument have nearly the uniform visual spacing of the Munsell Color System.

HUNTER

A new color-difference attachment gives components of color difference between sample and standard and then total color difference using an equation in which weighing factors may be adjusted to conform to visual grading practices for the product under study. Noteworthy features of the new instrument are: Digital dials which have separate plus and minus windows for the *a* and b scales; zero centered *a* and b potentiometers which eliminate polarity switches; electrical rather than mechanical adjustments to standard, Vacuum-tube galvanometer with rugged microammeter not disturbed by building vibration; and uniform indication of direction of rotation for all dials and scale knobs.

Hunter Associates Laboratory, Inc., Dept. PVP, 5421 Brier Ridge Rd., McLean, Va.

STRAINER

Flow Capacity of 1000 GPH

Now available for liquid lines is the stainless steel line strainer. Unit has been designed for filtration of fluids containing foreign solids. It has a rated flow capacity of 1000 gph with maximum view glass pressure of 50 psi. Overall size of assembled unit is 6½ x 6½ x 13" high.

Strainer is made "to clean in place" by opening clamp fitting at top and removing the filter screen. Air vent adjustment permits easy releasing of air bound lines.

Can be supplied with inlet and outlet fittings to specification.

Terriss Division, Consolidated Siphon Supply Co., Inc., Dept. PVP, 22 Wooster Street, New York, N. Y.

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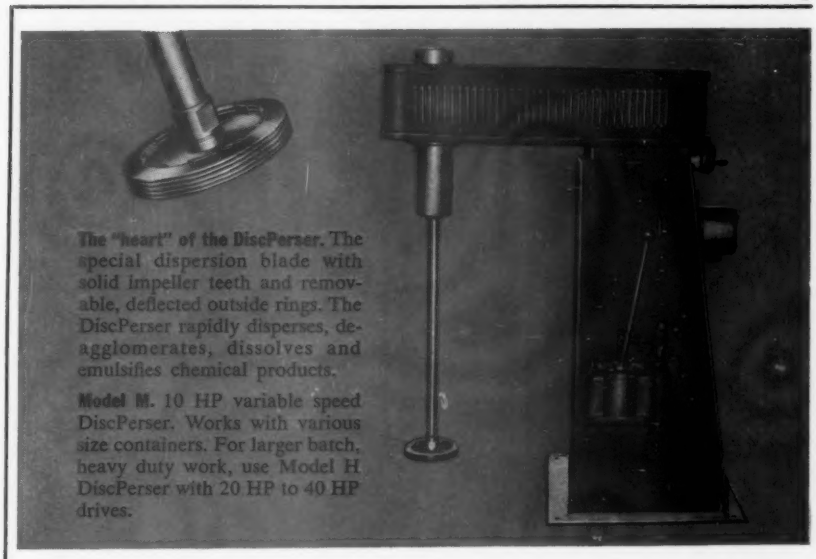
Long Life

Fragrances with a life of 2 to 5 years after application can be easily imparted to paint formulations with the aid of patented odor-retentive compounds.

Described as saponified derivatives of natural essential perfume oils, the new compounds have the unique feature of combining a relatively low initial emission of the fragrance and an extraordinarily long fragrance life. This is in sharp contrast to the action of essential oils which often emit an objectionably strong initial odor, with the effect rapidly diminishing within a few days.

The new compounds, which are very light in color and crystalline in form, are completely soluble in any organic solvent in use today. They are completely compatible and miscible with all of the pigments, oils, resins and other ingredients used in the formulation of surface coatings. Incorporation in existing


The "heart" of the DiscPerser. The special dispersion blade with solid impeller teeth and removable, deflected outside rings. The DiscPerser rapidly disperses, deagglomerates, dissolves and emulsifies chemical products.
Model M. 10 HP variable speed DiscPerser. Works with various size containers. For larger batch, heavy duty work, use Model H DiscPerser with 20 HP to 40 HP drives.

NOW! A finished dispersion in a single operation!

The new HOCKMEYER DiscPerser . . . produces very rapid ultimate dispersion...handles high-viscosity materials!

The DiscPerser's special blade operates at peripheral speeds in excess of 6000 FPM. The solid impeller teeth shred and break up pigment agglomerates. Material is discharged through the slots between the rings, at great speed and under intense hydraulic pressure. Tremendous fluid hammer action is developed by the smashing of material against the surfaces of these deflected outside rings. Material leaves the blade in thin, high-speed jet streams. Impact on the slower moving surrounding material creates further attrition and speeds the breakdown to original pigment particle size.

Versatile, the HOCKMEYER DiscPerser also: ● Cold cuts and dissolves exceptionally fast. ● Tints and lets-down unusually efficiently. ● Pre-mixes heavy bases for mill equipment; greatly increases the milling operation.

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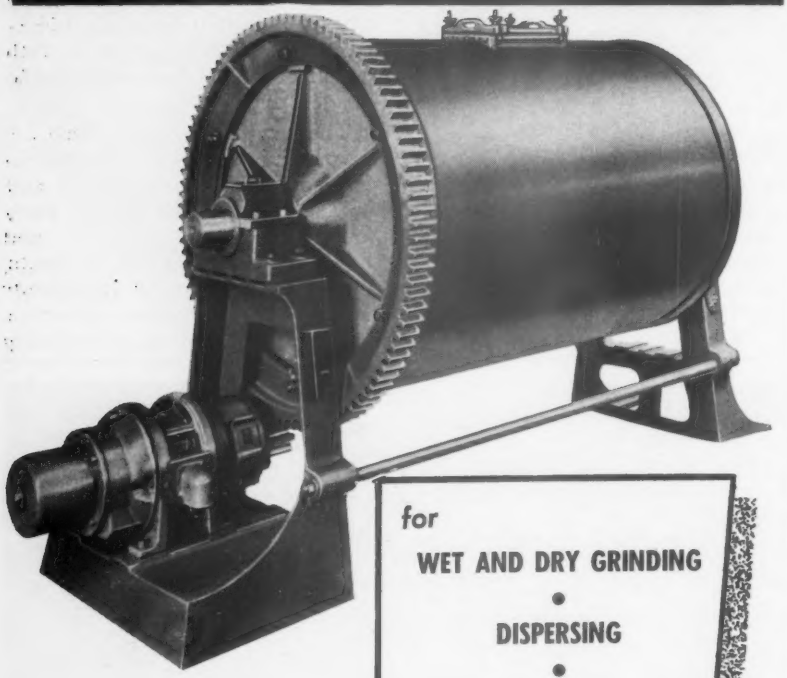

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ABBÉ Engineering Ball and Pebble Mills are available in capacities from 30 lbs. (dry), 5 gal. (wet), to 14,000 lbs. (dry), 2500 gal. (wet).

It will pay you to investigate these, as well as Abbé Jar Mills and Jar Rolling Machines, which cover every need and capacity.

Write for Catalogs 73 and 77 and complete data.

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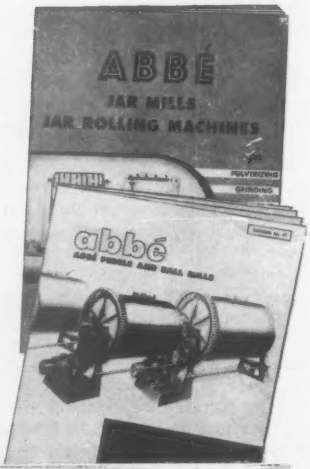

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paint formulations is merely a matter of adding the proper proportions of the odor-retentive chemical; no change in production process is involved.

Tyrex Drug and Chemical Corporation, Dept. PVP, 29 Pearl St., New York 4, N. Y.

PROTECTIVE CREAM
Wide Application

The problem of resins, solvents, lacquers, oils, pigments and acids which irritate and discolor the skin has claimed to have been solved by a newly developed barrier cream called "Kerodex."

Greaseless, stainless cream offers complete protection against acids, alkalis and other chemical irritants. Said to dry quickly and last a long time.

Tests have shown that "Kerodex" applied to hands and arms before work will prevent not only skin discoloration, but irritation.

Ayerst Laboratories, Dept. PVP, 22 East 40th Street, New York 16. N. Y.

POLYBUTENE
High Viscosity

A new Indopol polybutene with unusually high viscosity has been announced. This extends the line which now includes 10 products with viscosities ranging from 40 SSU at 210°F. to the new Indopol H-1900 having a viscosity of about 20,000 SSU at 210°F.

Promising applications for Indolpol H-1900 include use in adhesives and pressure sensitive tapes, as a thickening agent, and as a capacitor insulation impregnant. It may also be used in lubricants to improve shear stability and as a viscosity index improver.

Indopol H-1900 offers a number of important advantages in addition to its high viscosity and high molecular weight. It is non-drying, light in color and stable to sunlight, moisture resistant and thermally decomposes without residue at temperatures above 650°F. Indopol H-1900 also exhibits excellent electrical properties.

This new Indopol polybutene

is commercially available in drum and tank car quantities.

Amoco Chemicals Corp., Dept. PVP, 555 Fifth Ave., New York, N. Y.

RESINOUS SOLUTION
Multi-Application

New resinous solution has been developed.

The product, called Darasol, is claimed to be suitable for a diverse range of aerosol applications and other potential uses in conventional packaging.

In aerosol form, the product is said to be non-flammable, provides a low odor factor, and eliminates valve clogging and the need of special valve treatment.

Exceptionally fast drying and does not sag and run under ordinary application of even heavy coats.

Pigments and coloring materials of aerosol formulations do not settle out into solid masses in the container.

Available in one-gallon, five-gallon, and 55-gallon drums, either in clear or a wide range of colors.

Diamond Alkali Co., Chlorinated Products Division, Dept. PVP, 300 Union Commerce Bldg., Cleveland 14, Ohio.

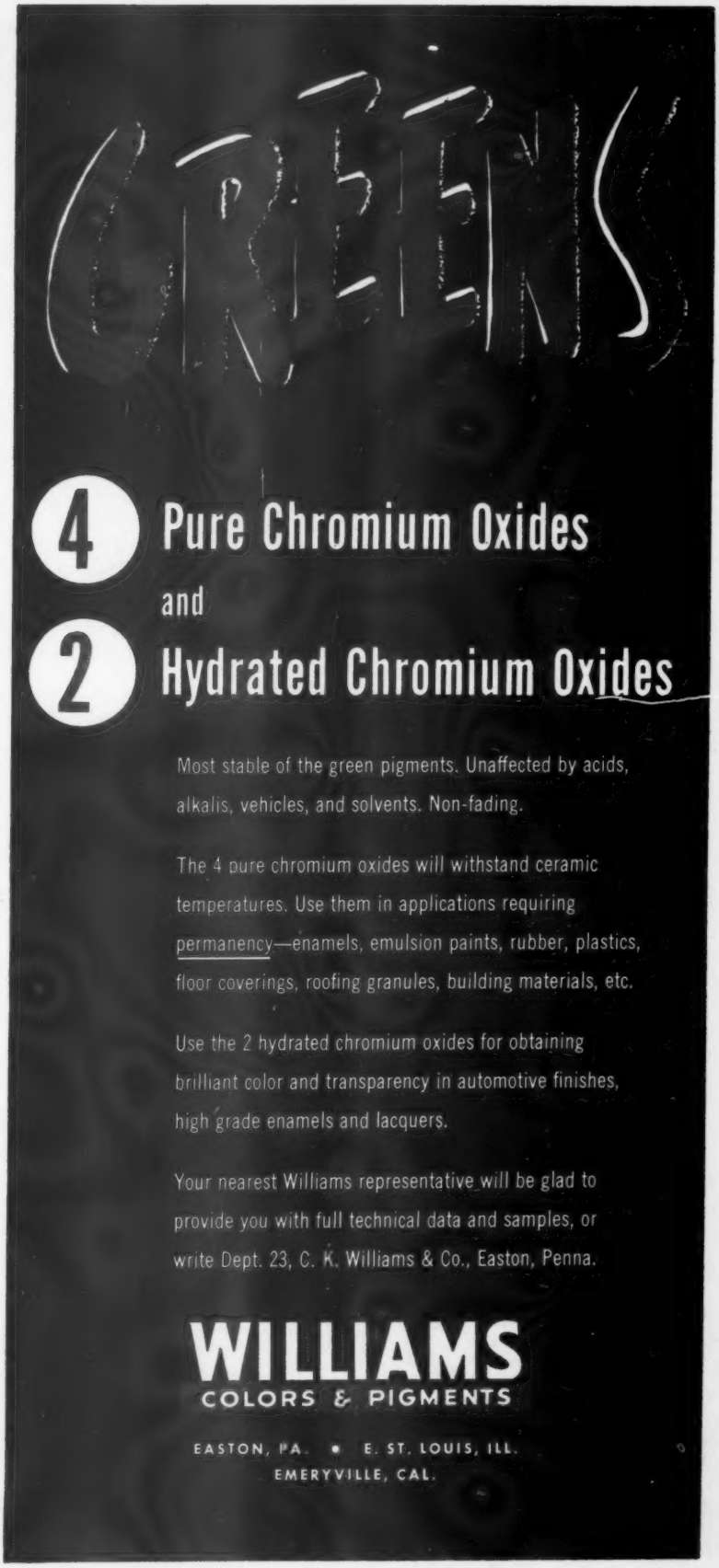
SOLVENTS
For Chromatographers

Five high-purity solvents certified as to mol percent purity now available.

This certification is a photocopy of the actual curve taken from the recorder of a Fisher-Gulf Partitioner, and is attached to each reagent. All five solvents have a minimum of 99 mol % purity. They meet American Chemical Society specifications (where these have been established) as well as those of the Fisher "Spectranalyzed" line (spectrophotometrically-pure solvents furnished with individual absorption curves).

The solvents are: A-20 *Acetone*; B-414 *Benzene*; C-570 *Carbon Tetrachloride*; A-936 *Methyl Alcohol*; and D-123 *Methylene Chloride.*

Fisher Scientific Co., Dept. PVP, 384 Fisher Bldg., Pittsburgh 19, Pa.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Hydrated Chromium Oxides
Most stable of the green pigments. Unaffected by acids, alkalis, vehicles, and solvents. Non-fading.
The 4 pure chromium oxides will withstand ceramic temperatures. Use them in applications requiring permanency—enamels, emulsion paints, rubber, plastics, floor coverings, roofing granules, building materials, etc.
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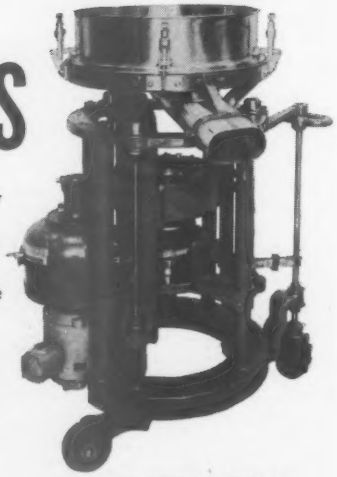

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GRADIENT HEAT

(*From page 61*)

more series of tests as a final quality control precaution to assure complete satisfaction with the finished product. The actual conditions under which the finished vehicle will be used are simulated in the Osborn laboratory. In the case of wrinkle paint vehicles, a batch of wrinkle paint is made up to satisfy a customer's specifications and sprayed on several test panels at controlled film thickness. The panels are then baked—some after a 10-min. air drying period, some after a 1 hr. air drying period. Timing is varied to show how users can allow for interruptions.

When baking is completed, each panel must meet the strictest criteria on luster, hardness, wrinkle size and pattern. Panels baked after a 10-min. delay must match exactly those baked after the 1 hr. delay. The same type of careful testing is exercised on all other resins for other applications.

Improved Production Costs Less

Outstanding economies have been noted at Osborn since the gradiation installation

Maintenance costs have been drastically reduced. It has been reported that the Duradiant settings have required no maintenance in almost 5 years of heavy-duty operation.

The use of gas as fuel has eliminated the need for messy, bulky piles of coke, or oil storage facilities. Pit and stack cleaning have been eliminated, as well as much of the normal routine of industrial "good housekeeping".

Operators no longer have to undergo a long training period to become adept at turning out high quality vehicles which adhere to absolute specifications.

Improved safety features have also added to Osborn's operating economy. The individual burners in each cluster are lighted from a single pilot flame but do not receive gas until the pilot flame is established by spark ignition. Further safety is assured by the enclosed setting—burning gas is within a closed chamber

USES

- Medium evaporating solvent in acrylic resin.
- Powerful economical solvent for vinyl acetate and vinyl chloride co-polymers.
- Solvent for nitrocellulose, and cellulose acetate butyrate.
- Preferred solvent in preparation of epoxy resin finishes.

PROPERTIES: 2-NITROPROPANE $CH_3CHNO_2CH_3$

Molecular Weight	89.09
Specific Gravity at 25/25°C	0.986—0.990
Pounds per U.S. Gal. at 68°F	8.24
Boiling Pt. at 760mm, °C	120.3
Flash Pt., °F (Tag Open Cup)	103.0
Solubility ml per 100 ml:	
Product in Water, 20°C	1.7
Water in Product, 20°C	0.6

CSC CHEMICALS FOR INDUSTRY

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Methanol Butanol
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Ammonium Nitrate, Solid and 83% Sol.
Methylamines
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Amyl Acetate Butyl Acetate
Butyl Lactate Butyl Stearate
Dibutyl Phthalate Ethyl Acetate
Tributyl Phosphate

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Nitroethane 2-Nitropropane
Nitromethane 1-Nitropropane
Alkaterges Diamines
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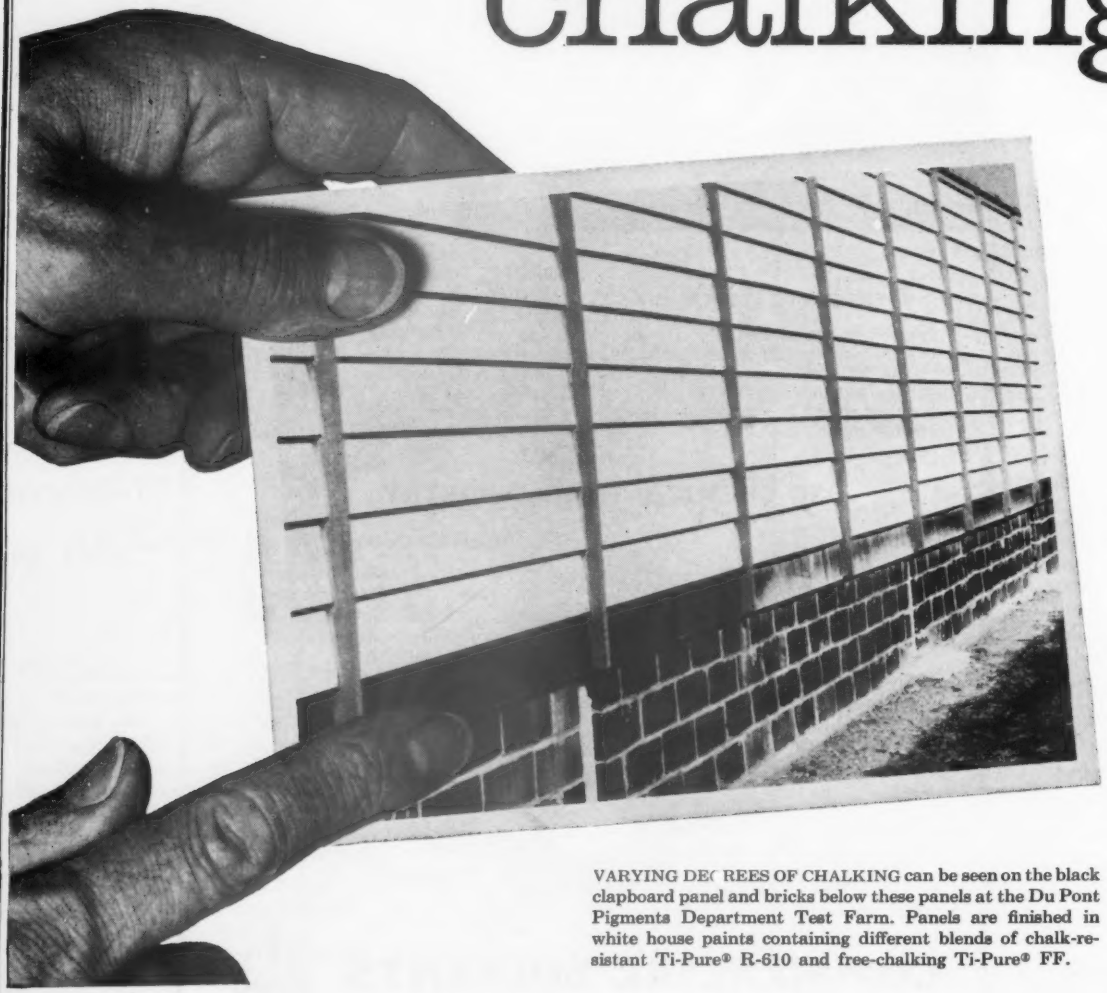
controlled chalking



VARYING DEGREES OF CHALKING can be seen on the black clapboard panel and bricks below these panels at the Du Pont Pigments Department Test Farm. Panels are finished in white house paints containing different blends of chalk-resistant Ti-Pure® R-610 and free-chalking Ti-Pure® FF.

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DU PONT TI-PURE® R-610 and FF

provide a range of chalk resistance for your exterior finishes

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UNMATCHED TECHNICAL SERVICE is available from Du Pont to help you solve a pigmenting problem. Year-round exposure histories on a wide range of formulations are available from 84 house tests and 36,000 panels at the Pigments Department Test Farm. For more information, call your Du Pont Pigments Representative, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington 98, Del. In Canada: Du Pont Company of Canada (1956) Limited, P.O. Box 660, Montreal, Quebec.

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ORGANIC COATINGS

(*From page 38*)

set time of drying, the organic film was dissolved again. Then the panel was dipped in the wash-primer again and allowed to dry for the same time interval. In this case the reaction occurred over the already produced surface layer of the first application. Again the paint was dissolved and the treatment repeated, continuing for a specified number of applications. As the repeated applications occur on already-pretreated surfaces, the coating effect comes to a standstill when the reaction has reached a certain degree. This point was determined in the following manner: the inorganic reaction coating which remains on the steel after the organic film has been dissolved can be dissolved from the weighed panels by immersion in a hydrochloric acid-formaldehyde solution and the amount of dissolved material, in milligrams, can be calculated in milligram per square foot of surface. It was observed that the coating weight obtained from a number of coatings increased in one test series from 46.3 mg/sq. ft. further on to 63.5 mg/sq. ft.; but afterwards subsequent treatments did not further increase the coating weights more than to 64.0 and 67.0 mg/sq. ft. This means that the inter-reaction has been slowed down to a range which has no more essential effectiveness. To analyse this inorganic coating, the same technique was then applied as in the method shown for phosphatizing reactions. The stripped matter was combined again with an internal standard material (gold chloride) and the same emission spectroscope method was applied. Table 5 shows the results of applications with 2,3,8, and 10 minutes "drying" time for each coat. In respect to the resulting coating weights of this series, some of the coatings are heavier in mg/sq. ft., than those mentioned from an earlier series; but here too the stripping weight from 4 minutes drying time and from 8 minutes drying time are so close in the same range that it appears that the time of contact during the drying is not of importance, after a certain coating weight has been reached. (In this Table the sample T-10 with 10 minutes drying time is from another series of applications and its coating weight appears to be somewhat lower even though its chemical composition is quite closely the same). Table 5-a gives the amount of phosphorus, chromium, iron and zinc, in milligrams of the dissolved matter; and Table 5-b gives these in percent of the stripped coating material. Since this material is produced over a certain surface to which the paint was applied, the results were calculated in milligrams per square foot of stripped coating, as shown in Table 6-a.

a) The coating compositions calculated in mg. per square foot of the stripped coating.

Element	T-2	T-4	T-8	T-10
P	1.638	2.473	1.49	2.376
Cr	0.00289	0.00353	0.00353	0.421
Fe	8.938	19.68	8.911	7.952
Zn	15.00	12.36	13.63	11.765

b) Comparing the Zn in content in % in the coating after deducting the iron content from the total solids.

Element	T-2	T-4	T-8	T-10
P	2.806	4.610	2.23	4.54
Cr	0.00505	0.0068	0.0052	0.81
Fe	- - - - - - - - - - - - - - - - - - - -			
Zn	28.0	22.73	24.2	21.02

Table 6. Calculated composition in mg. per sq. ft. of the stripped coatings.

The data still show unexpected variations, especially in the iron content of some of the applications, and these variations appear simultaneously with those in the phosphorus content. This simultaneous variation of iron and phosphorus content has been observed many times by this research group during studies on iron phosphate coatings. It is a clear expression of the fact that these coatings actually consist of iron-phosphorus materials.

Deducing from Table 6-b, the iron found in the analysis from the total solids and determining the percent zinc in the remaining coating matter, the results show an interesting degree of regularity. The investigations are still in progress.

These experimental findings on the steel surface differ from earlier reports in the literature. In these earlier papers [2] the wash-primer pigment received special attention. The new studies have shown: [1] that the emission spectrographic method can be applied to the study of paint-interface reactions, and that the reaction [2] produced from the wash-primer over 1010 steel is essentially an iron-zinc-phosphorus compound with chromium present in very small amounts only.

Literature Cited

(1) Kronstein, M., Kass S. and Van Dien, J. E. "Phosphatizing reactions on Steel" in *Paint and Varnish Production* (November 1959) Vol. 47, No. 12
(2) Rosenbloom H. "Chemistry of Wash Primer", in *Industrial and Engineering Chemistry*, **45**, 2561 (November 1953).

Acknowlegement

The author wishes to express his appreciation for the active cooperation which he received in the experimental work for this paper from Mr. R. Kraushaar and Robert Roper of New York University, from Robert E. Deacle of the ERDL on Fort Belvoir, Va., with regard to the infrared reflectance work, and Mr. J. E. VanDien of the Applied Spectrochemical Laboratories, Glen Rock, N. J., with regard to the emission spectroscopy work.

CYCLIZED RUBBER

(*From page 45*)

same results. This includes film hardness as well as drying, flexibility and chemical resistance of the films. Higher additions of di-octylphthalate cause considerable softening of the films. Incompatibility occurs if larger amounts of diphenoxy-ethyl-formal are used. Soft polyacrylates, such as polybutyl-acrylate can be used for the plasticization of cyclized rubber resulting in certain advantages from a paint technological stand point. The amount of acrylate resin which can be utilized depends entirely upon chemical resistance desired. For films of moderate chemical resistance, plasticization with polyacrylates up to 30% calculated on solid resin is permissible. For highly chemical resistant cyclized rubber coatings, an addition of polybutyl acrylate in the amount of 1-2% in combination with other plasticizers has proven its value without harming the resistant properties to an appreciable amount. This addition improves color and gloss retention of the paints, and increases solvent tolerance of the binder. Through variation of the polyacrylic-ester components, the regulation of viscosity is possible, resulting in savings either through viscosity increase or higher solvent tolerance.

For heat resistant coatings, a mixture of diphenoxy-ethyl formal as plasticizers (for the cyclized rubber coatings) has proven itself favorable. A composition containing 15-18% diphenoxy-ethyl formal can also be used.

TECHNICAL Bulletins

CHEMICALS LISTING

Antara Chemicals, Dept. PVP, 435 Hudson Street, New York 14, N. Y. offers an expanded and completely revised chemicals catalog.

For convenience, it is devided into separate sections devoted to surfactants, organic intermediates, acetylene derivatives, carbonyl iron powders, ethylene oxide and glycols and numerous specialty chemicals, including optical brighteners and ultra-violet light absorbers.

The new 64-page catalog describes the composition, properties and uses of the firm's products.

EPOXY RESIN SYSTEMS

A new technical bulletin, entitled "Liquid Polymer/Epoxy Resin Systems," has been published by Thiokol Chemical Corp. Dept. PVP, 780 North Clinton Avenue, Trenton 7, N. J. to serve as a basic reference manual for plastics compounders.

It provides general information on the increased flexibiltiy, impact and chemical resistance which are obtainable with this system for protective coatings and adhesives, as well as electrical potting, casting and plastic tooling applications.

This bulletin describes the proper methods for selecting and compounding liquid polymers with suitable epoxy resins, curing agents and fillers to obtain the desired handling and physical properties from the wide range possible. Charts and tables are included showing the effect of compounding variables on tensile strength, impact resistance, water absorption and other important physical properties which are available with this system.

SUCCINIC ANHYDRIDE

The physical and chemical properties as well as a wide variety of suggested uses of succinic anhydride are outlined in Technical Bulletin I-11 issued by thePublicity Department, Dept. PVP, National Aniline Division, 40 Rector St., New York 6, N. Y.

The 39-page brochure details many of the reactions of succinic anhydride and its acid. The bulletin also includes formulations, a bibiography, and physiological properties of succinic anhydride which is available in commercial quantities from the firm.

REACTIVE RESIN COATINGS

"New Spray Methods for Reactive Resin Coatings," a three-page technical bulletin, has been released by Union Carbide Plastics Co., Dept. PVP, 30 East 42nd St., New York 17, N. Y.

This literature describes a new method of spray-coating 100 per cent reactive systems based on Bakelite epoxy resins that results in curing speeds suited to application requirements.

Described by the company as Coatings Technical Release No. 45, the new bulletin explains the simplicity and flexibility of the new systems and how they are expected to reduce both high labor costs and application limitations inherent in conventional methods of applying 100 per cent reactive surface coatings.

GALVANIZED SURFACE PAINT

Red lead technical letter No. 13, entitled "L.I.A. Formula 9-2—A Single Red Lead Primer for Rusted, Weathered or New Galvanized Steel," has been published by

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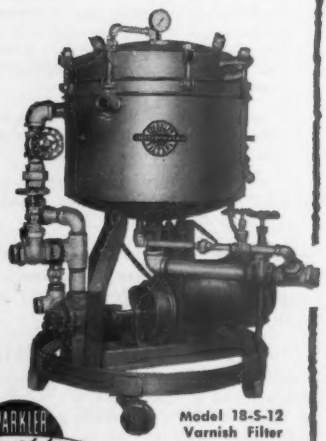

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Lead Industries Association, Dept. PVP, 60 East 42nd Street, New York 17, N. Y.

Unique characteristics of the paint are described and information regarding surface preparation is also included.

COLOR KIT

A functional Color Kit for architects, designers, builders, and maintenance men, showing how to use color scientifically to promote efficiency through better seeing conditions, avoidance of eye strain, and improved human and public relations, has been made available by Colorizer Associates, Dept. PVP, 345 North Western Ave., Chicago 12, Ill.

The kit includes four distinct brochures, each giving detailed color specifications for institutions in one of the following categories: motels, schools, hospitals, industrial plants. In addition, a set of recommended color standards, with 36 paint chips, is included to permit specifying paint colors by color number.

These Colorizer functional paint colors have been carefully chosen for industrial and commercial use —as distinct from home use—by a foremost authority on color. They include three groups of colors, according to application and function:

First, "Functional" colors, a group of grayish tones designed to relieve glare and simplify maintenance; second, "Decorative" colors, a group of cleaner, brighter hues best adapted for color-styling recreation areas, stores, hotels, etc.; and "Special" colors, brilliant hues, chiefly used in industrial plants for safety marking and color relief. Reflectance is given for each color.

RADIOACTIVE MATERIALS

New devices for remotely handling radioactive, toxic or highly flammable materials are described in a 20-page booklet made available by the Nuclear Equipment Department, Mechanical Division of General Mills, Inc., Dept. PVP, 1620 Central Avenue, Minneapolis 13, Minn.

Many service and maintenance mechanisms are illustrated and described in the new brochure.

Also described is the organization of the Nuclear Equipment Depart-

don't stop production flow
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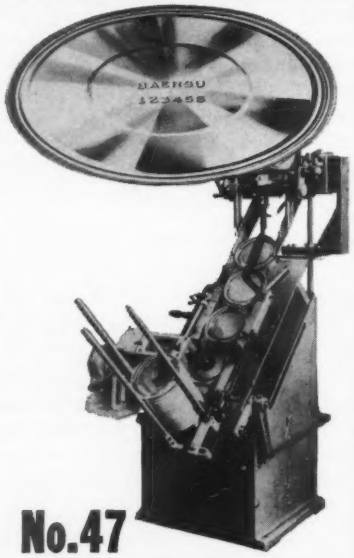
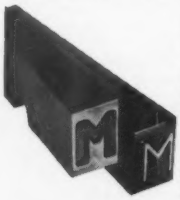


No.47
CAN LID CODER

Production schedules on filling and capping are never interrupted for lack of correctly coded can lids when there's a Matthews "47" coding machine on the line! Pre-coded lids are ready when you need them . . . clearly embossed and stacked for instant use. The "47" code embosses single, double and triple friction lids . . . square, round or oval-shaped—1⅛" to 9" in diameter. Write today for Bulletin C-12 which illustrates and describes the four models available.



Matthews male and female steel coding type is designed for instant code changes and long performance. Deep accurate engraving insures you of perfectly embossed characters.

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ment—the engineering and manufacturing facilities as well as the technical services available to designers, engineers and architects in the nuclear industry.

DRIERS & ADDITIVES

Advance Solvents & Chemical Div., Dept. PVP, 503 Jersey Ave., New Brunswick, N. J. has announced the publication of the new data sheet information book on driers and additives. Said to be the largest and most complete Drier and Additive book in the industry—107 pages, covering Advance standard driers and additives with eight main subjects and ten subdivisions.

The main subjects are: Driers, Drier Catalysts, Fungicides, Additives (Coating Control), Additives (Lacquer Control), Specialties, Stearates, Prices.

The sub-divisions are: Tallates, Octoates, Naphthenates, Advacar, Zirco, Control Products, Wetting Agents, Mercurial Fungicides, Waxes, Brighteners.

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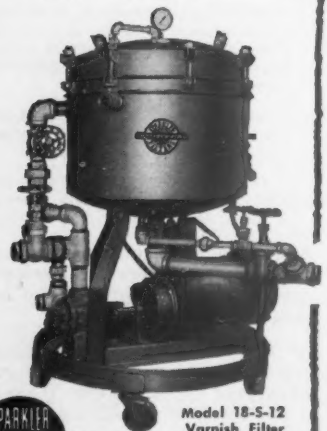

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Varnish Filter
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Lead Industries Association, Dept. PVP, 60 East 42nd Street, New York 17, N. Y.

Unique characteristics of the paint are described and information regarding surface preparation is also included.

COLOR KIT

A functional Color Kit for architects, designers, builders, and maintenance men, showing how to use color scientifically to promote efficiency through better seeing conditions, avoidance of eye strain, and improved human and public relations, has been made available by Colorizer Associates, Dept. PVP, 345 North Western Ave., Chicago 12, Ill.

The kit includes four distinct brochures, each giving detailed color specifications for institutions in one of the following categories: motels, schools, hospitals, industrial plants. In addition, a set of recommended color standards, with 36 paint chips, is included to permit specifying paint colors by color number.

These Colorizer functional paint colors have been carefully chosen for industrial and commercial use —as distinct from home use—by a foremost authority on color. They include three groups of colors, according to application and function:

First, "Functional" colors, a group of grayish tones designed to relieve glare and simplify maintenance; second, "Decorative" colors, a group of cleaner, brighter hues best adapted for color-styling recreation areas, stores, hotels, etc.; and "Special" colors, brilliant hues, chiefly used in industrial plants for safety marking and color relief. Reflectance is given for each color.

RADIOACTIVE MATERIALS

New devices for remotely handling radioactive, toxic or highly flammable materials are described in a 20-page booklet made available by the Nuclear Equipment Department, Mechanical Division of General Mills, Inc., Dept. PVP, 1620 Central Avenue, Minneapolis 13, Minn.

Many service and maintenance mechanisms are illustrated and described in the new brochure.

Also described is the organization of the Nuclear Equipment Depart-

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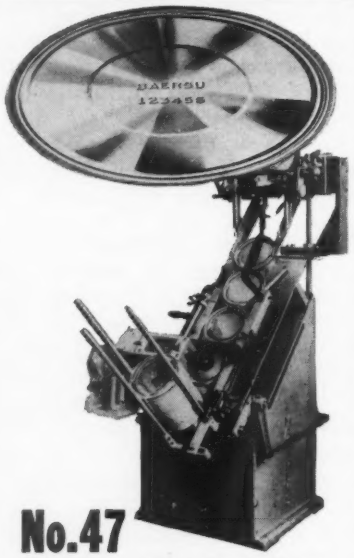

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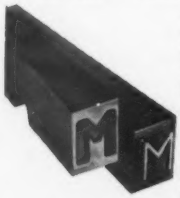

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scale unit and pulse height analyzer unit are also covered.

POWER-DRIVEN PUMPS

A revised Bulletin 20 published by Blackmer Pump Co., Dept. PVP, Grand Rapids 9, Mich., employs a total of 19 tables to aid in the selection of power-driven pumps for a wide variety of applications.

Tables in the 24-page bulletin cover the complete line of Blackmer industrial pumps, ranging in size from 1¼" through 8", with capacities from 10 GPM to 1580 GPM at differential pressures up to 125 psi.

The Bulletin 20 contains a six-step selection procedure for choosing the most suitable pump for a given application. This is prefaced with a brief outline of eight primary factors involved in the selection of a power-driven pump.

Other information provided in the bulletin is a description of the various mounting styles and drive units offered for each basic pump type; a listing of the various materials and types of construction available for each major component of all models; a simplified explanation indicating the pump types best suited to handling various industrial liquids; and a gear rating chart showing maximum horsepower rating of Blackmer gear reducers at various operating speeds and service conditions.

INVENTIONS WANTED

The 1958 supplement to "Inventions Wanted by the Armed Forces" has been published by the National Inventors Council, U. S. Department of Commerce, Washington 25, D. C.

There are 82 new problems facing the armed forces. These technological problems are periodically published in the hope that civilian inventors may solve them. Many of these problems are concerned with paint.

Also available is the basic 1957 edition listing more than 300 problems.

ELECTRICAL EQUIPMENT

"An Electrical Engineer Comes to Crouse-Hinds" is the title of a new six-page folder which has been made available by Crouse-Hinds Co., Dept. PVP, Syracuse 1, N. Y.

Bulletin 2710 describes design and construction principles involved in manufacturing Crouse-Hinds Condulet electrical equipment for hazardous locations.

Also emphasized is the great variety of explosion-proof equipment in everything from lighting to motor controls.

SPRAY EQUIPMENT

A complete data file on spray decorating equipment which includes electro-formed nickel and copper masks, mechanical and air operated clamps and pressure fixtures, automatic mask washers, and automatic spray decorating machines has been made available.

Conforming Matrix Corp., 402, Dept. PVP, Toledo Factories Building, Toledo 2, Ohio.

ISOMERIZED RUBBER RESINS

A booklet entitled "Syntex—isomerized rubber resins" has been made available by Bingham & Co., Inc., Dept. PVP, 135 Front St., New York 5, N. Y.

Included in the booklet are the following sections: Physical properties, various characteristics, chemical resistant paints, stoving enamels, air drying enamels, wall paints, and traffic paints.

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Write for Dicalite Bulletin C-23 which covers the many uses of Dicalite Filteraids and Dicalite Extenders in paint and varnish manufacture.

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Dicalite Department, Great Lakes Carbon Corporation • 612 So. Flower Street, Los Angeles 17, Calif.

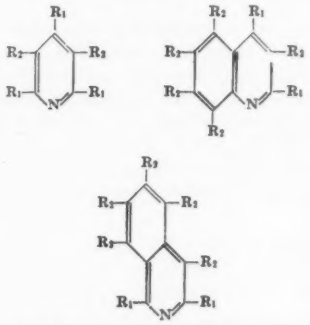
PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Modified Epoxies

U. S. Patent 2,860,120. James E. Pritchard and Peter J. Canterino, Bartlesville, Okla., assignors to Phillips Petroleum Co., a corporation of Delaware.

A thermosetting resin comprising the reaction product of an epoxy compound wherein an oxygen atom bridges adjacent carbon atoms, said carbon atoms, being joined by a single valence bond, said epoxy compound containing atoms selected from the group consisting of carbon, hydrogen, oxygen, and halogen in which oxygen atoms are present exclusively in radicals selected from the group consisting of hydroxyl and ether linkages, and a polymer of a compound having a structure selected from the group consisting of:



wherein at least one and not more than two of R_1 and R_2 are selected from the group consisting of vinyl and alpha-methyivinyl and at least one R_1 being alkyl containing not over 8 carbon atoms and having at least one hydrogen atom on an alpha carbon atom, R_1 and R_2 not otherwise substituted being hydrogen.

Acrylic-Cellulosic Coating

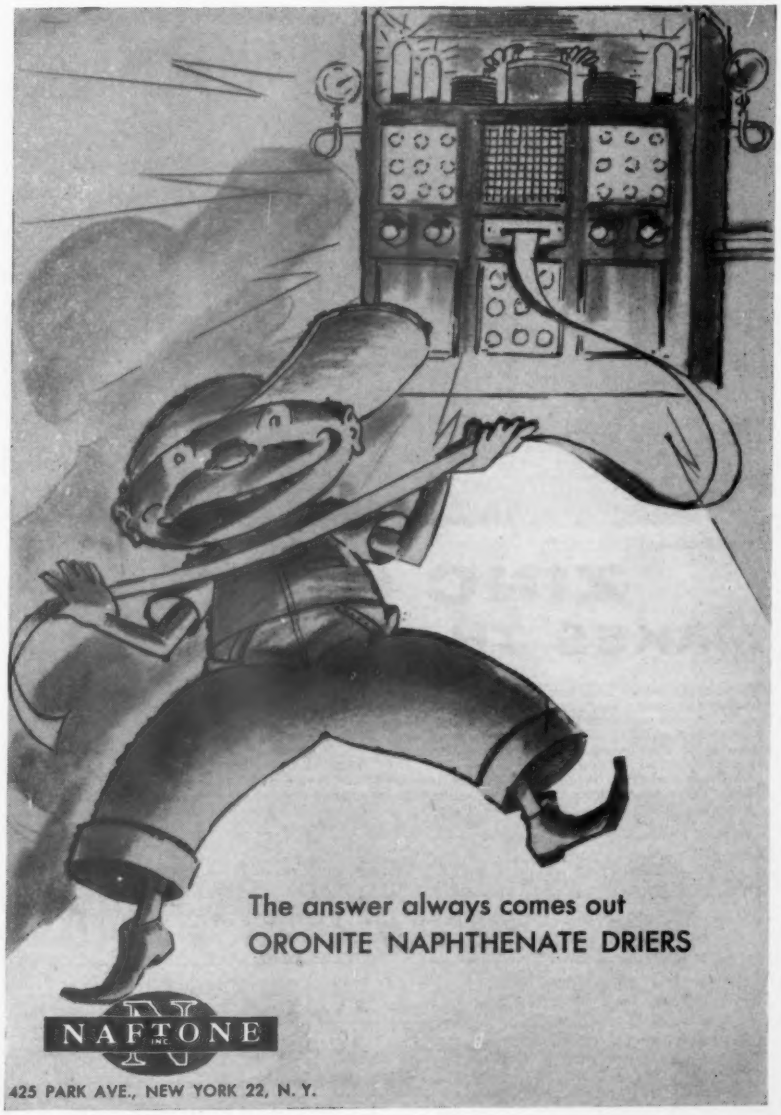
U. S. Patent 2,860,110. Henry W. Godshalk, Swarthmore, Pa., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del., a corporation of Delaware.

A pigmented coating composition, which produces a dry coating characterized by uniform pigment dispersion and by the absence of pigment flooding and mottling, comprising a polymer of methyl methacrylate as the preponderant film-forming material, volatile solvent therefore, plasticizer therefore, pigment and about 0.1-10%, by weight, based on the total weight of non-volatile constituents in said coating composition, of a cellulose ester selected from the group consisting of cellulose nitrate, cellulose propionate, cellulose butyrate, cellulose acetate butyrate, cellulose acetate propionate, and mixtures thereof, said polymer of methyl methacrylate being at least one material of the group consisting of homopolymers of methyl methacrylate and copolymers of methyl methacrylate with from 2 to 25% by weight of a member of the group consisting of acrylic acid, methacrylic acid, a 1 to 4 carbon alkyl ester of acrylic acid, a 2 to 4 carbon alkyl ester of methacrylic acid, vinyl acetate, acrylonitrile and styrene; and said polymer of methyl methacrylate being further characterized by having a relative viscosity of about 1.117 to 1.196 said relative viscosity being the quotient obtained by dividing the efflux time of a solution of 0.25 gram of said methyl methacrylate component in 50 cc. of ethylene dichloride by the efflux time of ethylene dichloride, said efflux times being measured in accordance with the procedure of ASTM D-445—46T, Method B, at 25°C. using a modified Ostwald viscosimeter, series 50.

Methylolated Compositions

U. S. Patent 2,859,204. Frank P. Florentine, Jr., Stockbridge, and Edmond F. Fiedler, Adams, Mass., assignors to General Electric Co., a corporation of New York.

The method of preparing resinous condensation products which comprises (1) reacting together, under alkine conditions, (*a*) a mixture of spaced

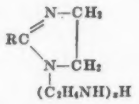


polyphenols, said spaced polyphenols comprising the product of heat reacting in the presence of a Friedel-Crafts catalyst (i) a monohydroxy benzene compound selected from the group consisting of monohydroxy benzene and substituted monohydroxy benzene in which the substitution is selected from the group consisting of alkyl groups, alkoxy groups and halogen radicals and (ii) a mixture of chlorinated hydrocarbons having from about 12 to about 30 carbon atoms per molecule, from about 15 to about 45 percent, by weight of the chlorinated hydrocarbon, of chlorine and having a molecular weight in the range of about 250 to about 600, and in which spaced polyphenols the average degree of substitution of hydrocarbon groups per monohydroxy benzene ring is less than three, with (*b*) a reactive methylene compound selected from the group consisting of formaldehyde and paraformaldehyde, to form a mixture of methylolated spaced polyphenols, the reactive methylene compound being present in sufficient quantity to give a number of methylene groups equivalent to from one-half the total number of free reactive ortho and para positions available on the monohydroxy benzene rings in the spaced polyphenols up to a number of methylene groups equivalent to the total available reactive ortho and para positions in the spaced polyphenols, and (2) thereafter reacting the resulting methylolated products, in the presence of an acid catalyst, with a phenol selected from the group consisting of phenol and substituted mono-phenols in which the substitution is selected from the group consisting of alkyl groups, alkoxy groups and halogen radicals.

Rust Preventive Composition

U. S. Patent 2,860,996. Michael J. Furey, Berkeley Heights, N. J., assignor to Esso Research and Engineering Co., a corporation of Delaware.

The method of improving the storage stability of cutback asphalt-base thin film rust preventive compositions which comprises blending with said compositions a minor but viscosity-stabilizing amount of a wax amine compound having the formula:



wherein R is a monovalent saturated hydrocarbon radical having from 40 to 80 carbon atoms and wherein x is a number of from 1 to 2.

Stain and Method of Application

U.S. Patent 2,855,369. Russel D. Hamilton, Detroit, Mich., assignor to Chadeloid Corp., Dayton, Ohio, a corporation of Delaware.

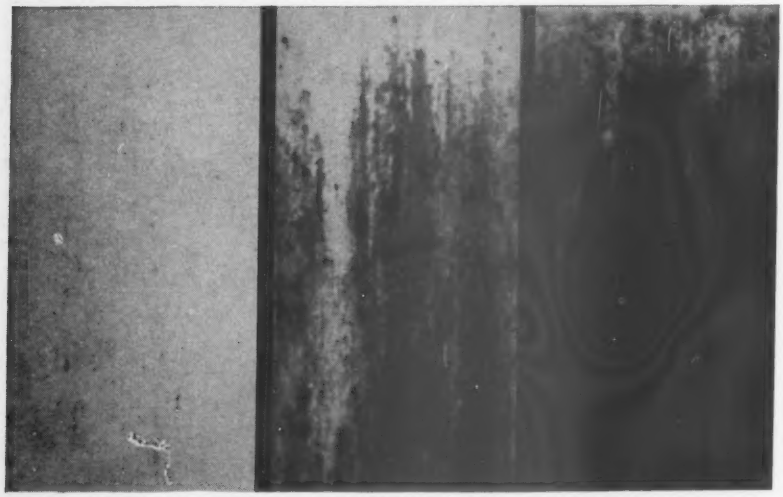
A wood staining composition consisting of the reaction product of chromic chloride and sodium carboxymethyl cellulose dissolved in alkaline tetrahydrofurfuryl alcohol containing 0.8% of sodium hydroxide, and sodium salt of 4,4 di(o-amino-benzoylamine)stilbene-2,2′-disulfonic acid.

Tough, Impact-Resistant Resins

U. S. Patent 2,859,203. Edmond Frank Fiedler, Adams, and Frank Paul Florentine, Jr., Stockbridge, Mass., assignors to General Electric Co., a corporation of New York.

The method of preparing fusible, soluble, thermosetting, resinous, reaction products by reacting at a temperature of from about 50 to about 180°C., (1) from about 5 to about 95 percent, by weight of the reaction mixture, of spaced polyphenols, said spaced polyphenols comprising (*a*) the product of heat reacting in the presence of a Friedel-Crafts catalyst, a monohydroxy benzene compound selected from the group consisting of monohydroxy benzene and substituted monohydroxy benzene in which the substitution is selected from the group consisting of alkyl groups, alkoxy groups, and halogen radicals and (*b*) a mixture of long-chain chlorinated hydrocarbons containing from about 12 to 30 carbon atoms per molecule and from about 15 to about 45% of chlorine, by weight of

In any area... in exterior house paints



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These three panels have weathered six months on southern exposure in Florida. The panel at left is coated with a standard house paint containing adequate zinc oxide . . . the others with a commercial zinc-free exterior paint. The one at center is formulated with a commercial mildewcide.

Mildew resistance is desirable in any housepaint. These panels demonstrate that paints containing adequate zinc oxide are more resistant to mildew than those which depend on chemical additives. But proper zinc oxide contents do much more than just impart mildew resistance.

Adequate ZnO provides durability and film integrity . . . resists staining by soluble dyes . . . withstands destructive effects of ultraviolet light . . . imparts better control of chalking characteristics. In short, ZnO lengthens the life, improves the service and appearance of any good paint.

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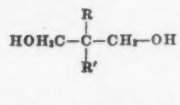
Zone_____ State_____ City_____

the chlorinated hydrocarbons, the reactants being present in such proportions that the combined chlorine to phenol ratio is from 0.1 atom of chlorine per mol of phenol up to two atoms of chlorine per mol of phenol, (2) from about 5 to about 95 percent by weight of the reaction mixture, of a phenol selected from the class consisting of phenol and substituted monophenols in which the substitution is selected from the group consisting of alkyl groups, alkoxy groups and halogen radicals, and (3) a sufficient quantity of hexamethylenetetramine to give a number of methylene groups equivalent to from ½ the total number of free ortho and para positions in the phenol and monohydroxy benzene rings in the spaced polyphenol up to a number of methylene groups equivalent to the total number of available reactive ortho and para positions on the monohydroxy rings present in the spaced polyphenols and the phenol.

Alkyd-Amino Resins

U. S. Patent 2,860,119. John C. Petropoulos, South Norwalk, and Leonard E. Cadwell, Stamford, Conn., assignors to American Cyanamid Company, New York, N. Y., a corporation of Maine.

A composition of matter comprising a mixture of from 70 to 30 parts of (1) an alkyd resin comprising the heat reaction product of a member selected from the group consisting of phthalic acid and phthalic anhydride with a polyhydric alcohol having the formula:



wherein R is a member of the group consisting of a —CH_2OH group, an alkyl group and an aryl group, R′ is a member of the group consisting of alkyl and aryl groups, wherein the number of carbon atoms in R and R′ totals at least 6, and correspondingly from 30 to 70 parts of (2) a thermosetting aminoplast resin.

Low Temperature Preparation Alkyds

U. S. Patent 2,861,047. John S. Heckles, Lancaster Township, Lancaster County, Pa., assignor to Armstrong Cork Co., Lancaster, Pa., a corporation of Pennsylvania.

The method of making an alkyd resin comprising reacting at a temperature in the range of about 150°-250°C. a long chain fatty acid obtained from an oil selected from the group consisting of drying oils, semi-drying oils, nondrying oils, and mixtures thereof with pentaerythritol in the ratio of about 1.3 to 2.2 equivalents of fatty acid to about 3 equivalents of pentaerythritol to form fatty acid-pentaerythritol diester, dissolving in said diester at a temperature in the range of about 220°-260°C. about 0.5-1.5 equivalents of isophthalic acid, and reacting with the resulting product about 0.3-2.5 equivalents of said long chain fatty acid.

Wax and Shellac Polishing Composition

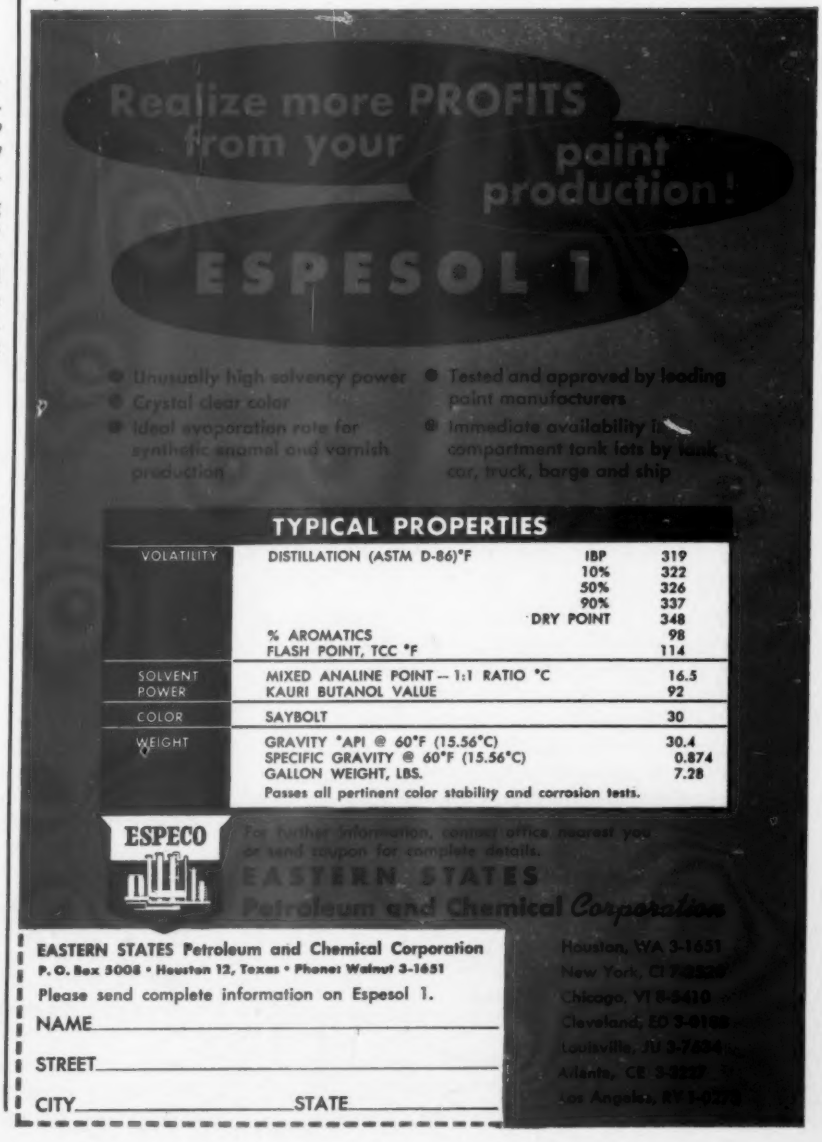
U. S. Patent 2,859,123. Thomas B. Smith, Chicago, Ill., assignor to Simoniz Co., a corporation of Delaware.

A polishing composition capable of drying to a high clear luster, comprising: water; shellac in an amount of about 7.5-10% by weight of the composition having an acid number of at least about 65; borax in an amount substantially only sufficient to solubilize the shellac in the water, this amount being not substantially greater than about 1.7% by weight of the composition and about 12-16% by weight of the shellac; and a water insoluble wax as an essential ingredient dispersed in said water, the composition having a total solids content of about 10-17% by weight of the composition.

Asphalt Roofing Composition

U. S. Patent 2,859,125. Ralph R. Uhrmacher, Fort Worth, Tex., assignor to Panther Oil & Grease Mfg. Co., Fort Worth, Tex., a corporation of Texas.

A roofing composition consisting of an asphalt blown in the presence of phosphorus pentoxide and a solvent comprising a mixture of xylene and petroleum naphtha.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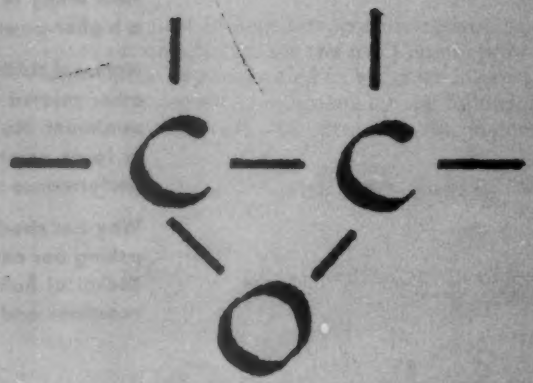
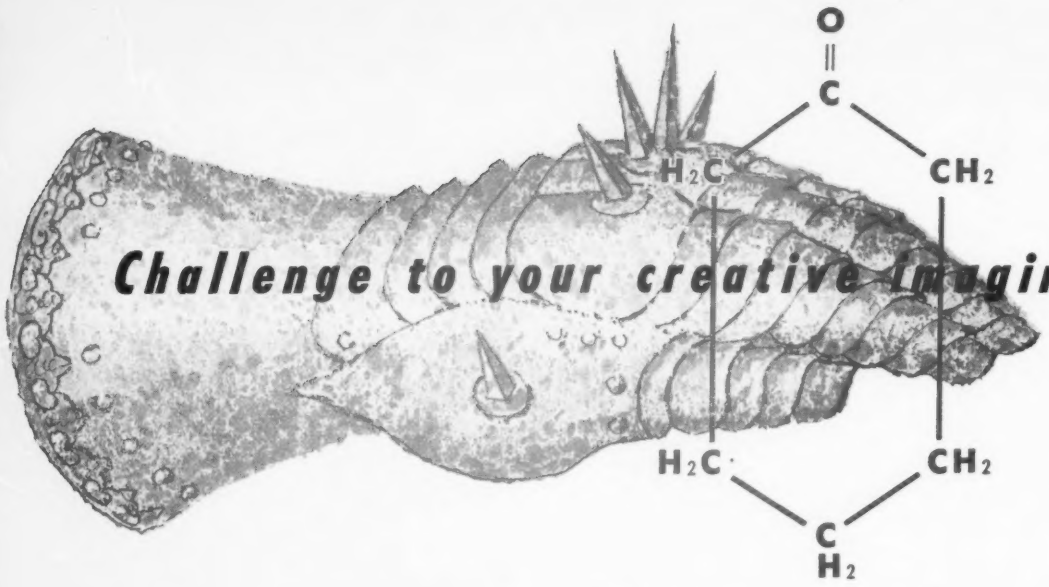
foreign developments

British Research on Epoxidized Oils, Part II

Soviet and Polish Abstracts



This is the epoxide group which can undergo numerous chemical reactions forming epoxy-containing compounds of interest in coatings. For an exhaustive discussion of the chemistry of the epoxide group, see page 83..



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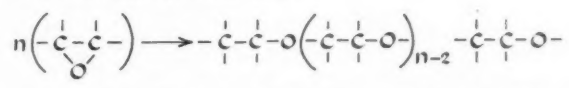
A New Development from England—

Surface Coatings from Epoxidized Oils

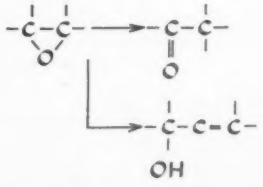
Part II

OF GREAT interest to the protective coatings chemist is the ability of the epoxy linkage to undergo self-polymerization as indicated in the following equation (21):



This reaction is utilized commercially when ethylene oxide is polymerized to the polyethylene oxides or propylene oxide is polymerized to the polypropylene oxides. A variety of catalysts, including bases, acids, boron trifluoride and Friedel-Crafts-type catalysts will effect the reaction. Actually, epoxidized soybean oil may be self-polymerized to a crosslinked gel by utilizing this reaction. By controlling it, it is entirely possible that interesting coating intermediates could result.

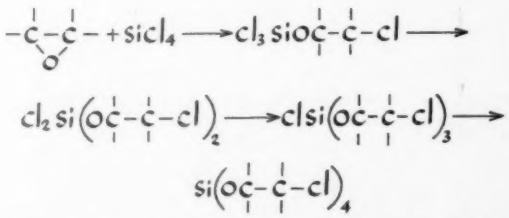
Related to polymerization is the ability of the epoxide group to rearrange itself in at least two possible ways as indicated below (22):



It may be seen that the rearrangement of the epoxide group creates new functional groups, such as ketone and hydroxyl groups which are available for further reaction.

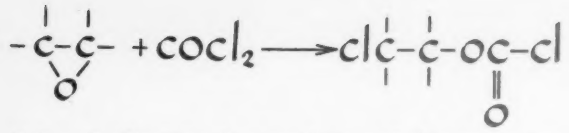
The various reactions of epoxy groups presented in this installment is to give the paint chemist an idea of the numerous chemical reactions that the epoxide group may undergo. Part III, scheduled for the February issue, will cover in detail epoxidized oils, their preparation, properties, and uses.

The interest in high temperature-resistant coatings based on silicones makes the reaction of epoxy groups with silicon tetrachloride of particular interest. This reaction proceeds as indicated by the following series of equations (23) to provide silicon-containing

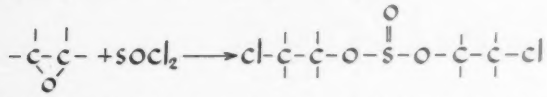


molecules. Undoubtedly silicon materials other than the tetrachloride will react with the epoxide linkage.

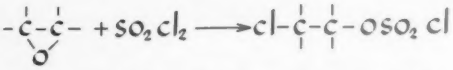
There are a variety of simple molecules which under go interesting reactions with the epoxy linkage. Among these are phosgene which reacts as indicated below (24):



Although phosgene is a noxious and dangerous gas, it is now used commercially in the preparation of the diisocyanates. Related to this reaction is the interaction of the epoxide group with thionyl chloride according to the following equation (25):

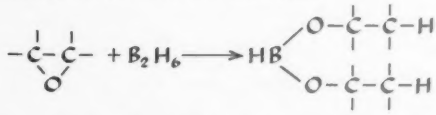


Sulfuryl chloride reacts in a similar fashion according to the following equation (26),

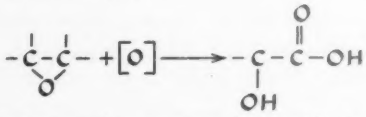


whereas nitrosyl chloride reacts as follows (27):

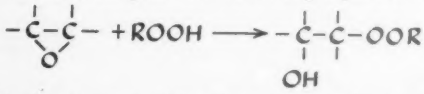
The interest which currently exists in boron chemistry, together with the availability of certain boron chemicals, makes the reaction of the epoxide linkage with diborane interesting. It proceeds according to the following equation (28) and provides a means for introducing boron into the molecule:



The reaction of oxidation is well familiar to the paint chemist who learns very early in his career that linseed oil is converted from a mobile liquid to a hard resistant film by the phenomenon of oxidation. Epoxy groups may also be oxidized as the following equation indicates (29):

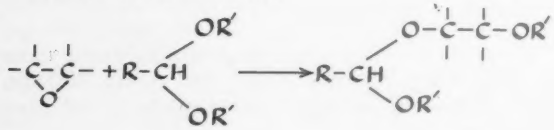


Again, it is interesting to note that oxidation, like rearrangement, creates new functional groups for further reaction. Closely related to simple oxidation is the interaction of the epoxy groups with alkyl hydroperoxides according to the following equation (30):



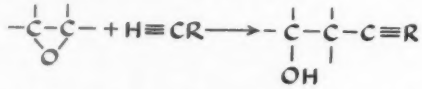
The alkyl hydroperoxides also are well-known to the paint chemist who utilizes them as catalysts with mixtures of polyesters and styrene to obtain hard, glossy, solventless plastic coatings.

Epoxy groups will react with acetals according to the following equation (31):



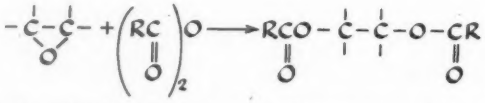
Although the acetal linkage does not occur with high frequency in protective coating intermediates, it does provide the basis for the polyvinyl acetal resins, such as polyvinyl butyral which is used in wash primers. These resins also form the basis for the interlayers in safety glass.

Epoxy groups will react with the acetylene linkage according to the following equation (32):



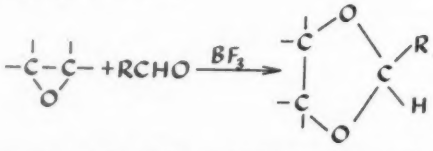
This is particularly interesting reaction, since the acetylene unsaturation is retained and a hydroxyl group is generated. Acetylene compounds which in the past, except for acetylene itself, have been quite rare are now available, at least in development quantities.

The interaction of the epoxy group with acid anhydrides proceeds according to the following equation (33):



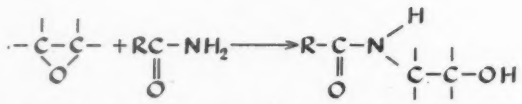
Simple anhydrides, such as acetic or propionic anhydrides, are well-known and are used in the manufacture of cellulose esters such as cellulose acetate and cellulose propionate. Aromatic anhydrides such as phthalic anhydride are, of course, the backbone of the alkyd industry. Maleic anhydride also is important in the alkyd industry. Anhydrides are used to cure epoxy resins, particularly when good electrical properties are desired. More recently, very interesting dianhydrides, such as pyromellitic anhydride, have become available.

Epoxy groups will react with aldehydes, particularly in the presence of boron trifluoride according to the following equation (34):



Compounds such as benzaldehyde have, of course, been known for many years. Compounds such as acetaldehyde and butyraldehyde are also available in large quantities.

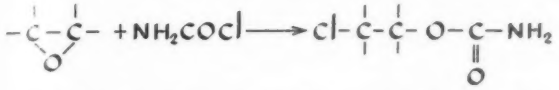
An interesting reaction results between the epoxy group and amides according to the following equation (35):



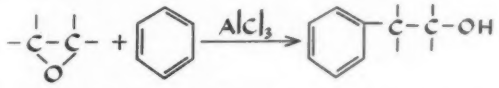
Here again, it is apparent that a number of reactions may take place depending on whether the amide is primary or whether it is substituted. Simple amides such as acetamide and benzamide are readily prepared. Fatty amides such as stearamide are also available commercially as is ethylene bis-stearamide. Resins containing the amide linkage are, of course,

well-known and include the nylon-type polymers as well as the low molecular weight polyamides. Urea may be considered as a diamide of carbonic acid.

Carbamyl chloride, which may be considered as phosgene, in which one chlorine has been replaced by an NH_2 group reacts with the epoxy linkage according to the following equation (36):

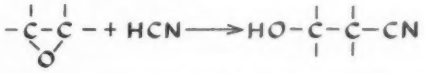


The epoxide linkage may be caused to undergo a Friedel-Crafts reaction with aromatic compounds as the following equation demonstrates (37):

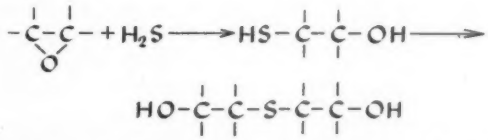


Although the Friedel-Crafts reaction is not widely used in industry outside of the pharmaceutical field, it offers to the paint chemist interesting possibilities for conjecture.

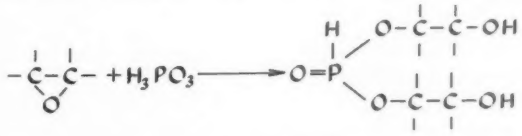
The reaction of hydrogen cyanide with epoxy groups proceeds as follows (38):



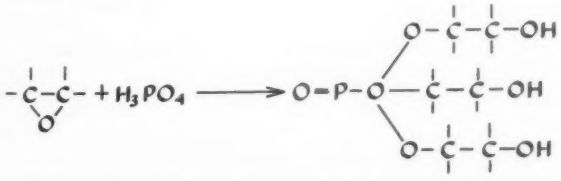
whereas the reactions with hydrogen sulfide are some what more complex as the following equation demonstrates (39):



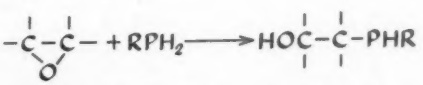
The epoxy linkage offers numerous procedures for introducing phosphorus into a molecule because of its reactivity with a variety of phosphorus compounds. Thus, with phosphorous acid, it reacts as follows (40):



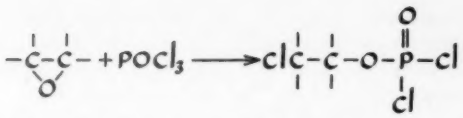
With phosphoric acid, the following reaction takes place (40):



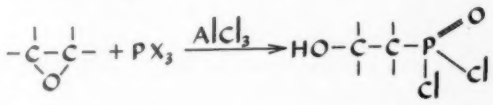
With phosphines, the following reaction takes place (41),



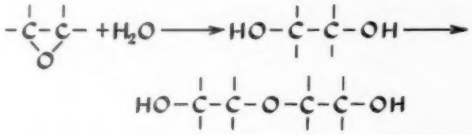
whereas with phosphorus oxychloride, the reaction proceeds as follows (42):



Phosphorus trihalides react in the presence of Friedel-Crafts catalysts such as aluminum chloride according to the following equation (43):

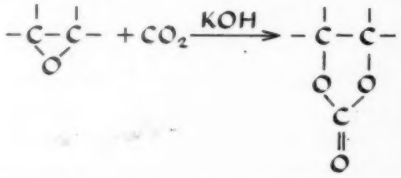


The reaction of water with the epoxy linkage is interesting and proceeds according to the following reaction (44):

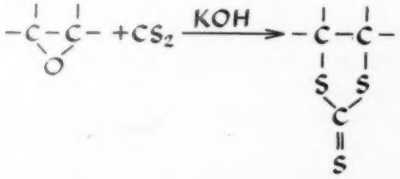


This reaction points out the need to keep the reagents anhydrous if one is to prevent undesirable side reactions.

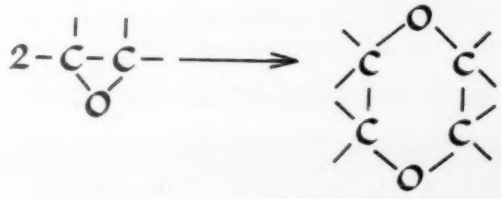
There are a number of reactions in which the ring structure is preserved, although modified. The reaction of the epoxy group with aldehydes, described above, is one such reaction. Others are the reaction of the epoxy group with carbon dioxide according to the following equation (45),



and the reaction with carbon disulfide according to the following equation (46):



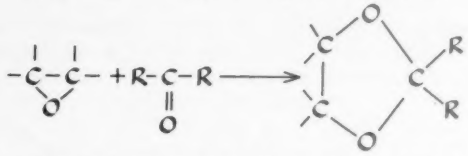
Two molecules of epoxide may condense to form a dioxane compound according to the following equation (47):



This, of course, is the manner in which the compound dioxane is actually formed from ethylene oxide. It may be seen that when this reaction is carried out

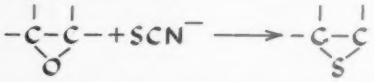
with epoxide groups in large molecules, highly complex structures can result.

Ketones react with epoxides to provide cyclic structures according to the following equation (48):

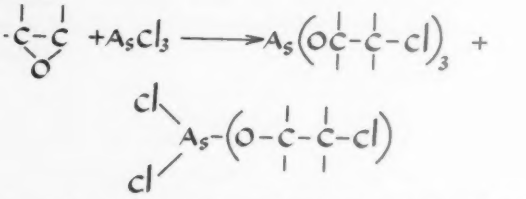


A variety of ketones are, of course, available commercially, starting with the simplest, acetone, and including stearone, the very high molecular weight distearyl ketone.

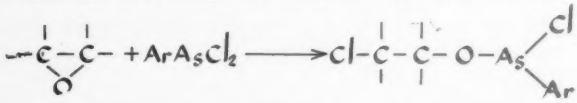
The reaction of the epoxy group with thiocyanates preserves the cyclic structure as the following equation shows (49):



Several of the above equations have indicated how the epoxide linkage may be used to introduce into a molecule inorganic atoms such as boron, phosphorus, and silicon. There are still other reactions of this type, such as the reaction of the epoxide linkage with arsenic trichloride according to the following equation (50):

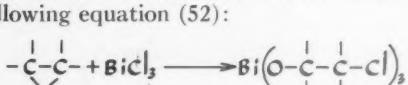


Arsenic may also be introduced into the molecule by the reaction of the epoxide linkage with aryl dichloroarsines according to the following equation (50):

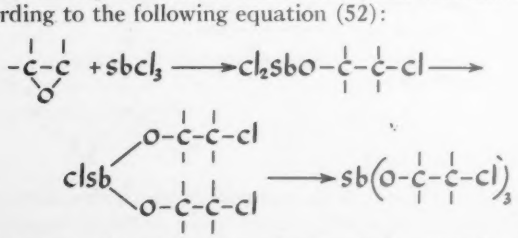


Aryllithiums react with the epoxide linkage as the following equation demonstrates (51),

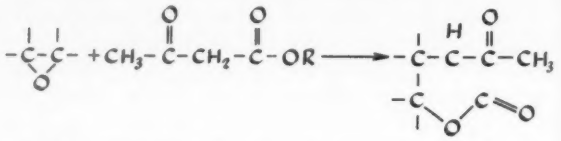
whereas bismuth trichloride reacts according to the following equation (52):



Antimony trichloride reacts in similar fashion according to the following equation (52):

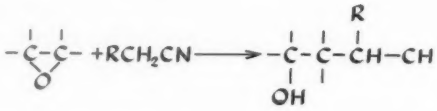


Among other reactions of general interest is the interaction of the epoxide group with acetoacetates according to the following equation (53):



Ethyl acetoacetate is, of course, well-known. Higher compounds in this class are not articles of commerce.

Acetonitriles react with the epoxide linkage according to the following equation (54):

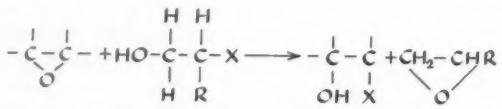


Phenyl acetonitrile, for example, is available. In general, however, this class of compounds is relatively rare.

Acyl halides such as those used for detergent manufacture react with the epoxide linkage according to the following equation (55):

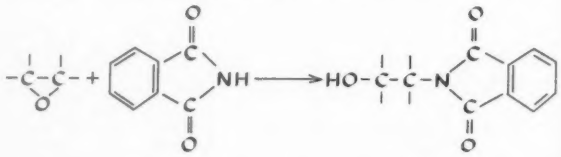
Alkyl halides which also are commercially available for rather specific reactions interact with the epoxide linkage according to the following equation (55):

Halohydrins react with the epoxide linkage according to the following equation (56):



Ethylene chlorohydrin is, of course, a readily available halohydrin.

An interesting reaction results when phthalimide, a common dye intermediate, reacts with the epoxide linkage as the following equation demonstrates (57):



The sulfonic acid group may be introduced into a molecule by the reaction of the epoxide group with sodium sulfite according to the following equation (58):

Thiosulfates, on the other hand, react according to the following equation (59) to accomplish the same

net effect as the interaction with sodium sulfite.

The above rather exhaustive discussion of the chemistry of the epoxide group is intended to give the paint chemist an overall view of the vast number of possibilities which exist for involving epoxy-containing compounds, such as epoxidized soybean oil , inreactions which may lead to new and useful protective coatings. The reactions have been arranged roughly in the order of possible interest, particularly from the point of view of the availability of coreactants with which the paint chemist is already familiar.

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SOVIET and POLISH ABSTRACTS

One aspect of Soviet Polymer Research in which there seems to be intense effort is silicone chemistry, particularly in developing organo-silicone compounds.

Of considerable interest is the work of Petrov and his co-workers on the catalytic addition of hydrosilanes to unsaturated and aromatic compounds; the development of high-temperature condensation products of hydrosilanes with alkyl-, aryl- and alkenyl-halides; and the synthesis of polymerizable silicon-hydrocarbons and their derivatives. Petrov succeeded in synthesizingsuch silicone containing monomers of butadiene, acrylic acids, vinyl esters and acetals. Paralleling this development was some recent work done by Korshak and his staff in developing polyamides with siloxane groups which exhibit rubber-like properties.

Types of Silicon-Containing Monomers

By A. D. Petrov, V. F. Mironov, V. A. Ponomarenko, E. A. Chernyshev, & S. I. Sadyzh-Zade, "Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk," 8:954-963, August 1958.

First publication of results of investigations on a) catalytic addition of hydrosilanes to unsaturated and aromatic compounds, b) high-temperature condensation of hydrosilanes with alkyl-aryl- and alkenylhalides, c) the synthesis of polymerizing silicon-hydrocarbons and their derivatives. In presence of H_2PtCl_6 and at temperatures of 20-60°C, alkyldichlorosilanes form compounds with $CH{=}CH$, $CH_2{=}CH_2$, $CH_2{=}CHCH_3$ with nearly quantitative yields. Alkyldichlorosilanes show very high yields of addition products in the presence of platinum catalysts, whereas silicochloroform gives higher yields in the presence of peroxides. Di- and trichlorosilanes were prepared by condensation of alkyldichlorosilanes and silicochloroform with aryl- and dialkenylhalides at 600°C. Si-containing derivatives of butadiene, acrylic acids, vinyl esters and acetals, forming linear solid monomers under atmospheric pressure, were synthesized for the first time. Corresponding member of the Academy A. D. Petrov reported the above results at the General meeting of the Academy's Division of Chemical Sciences on April 25, 1958.

Properties of Polyamides With Siloxane Groupings

By V. V. Korshak, P. M. Frunze, D. N. Andreev, & E. V. Kukharskaia, "Zhurnal Obshchei Khimii," Vol. 28, 7:1997-1998, July 1958.

To investigate the influence of siloxane groupings on polyamides, the latter were synthesized from three dicarbonic acids by polycondensation with various aliphatic and aromatic diamines. The introduction of siloxane groups into these polyamides results in the formation of polymers with rubber-like properties; in comparison with azelaic acid polymers, they have lower melting points. This is taken to be results of both the effect of siloxane groups as well as the presence branch substitution with Si atoms.

Organo-Silicon Compounds

By K. A. Andrianov, V. E. Nikitenkov, L. A. Kukharchuk, & N. N. Sokolov, "Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk," 8:1004-1005, August 1958.

First compounds with phenylene-siloxane molecular chains, framed by methyl groups, were prepared by the action of Mg on *p*-dibromobenzene, with subsequent decomposition of the Grignard reagent by dimethyldichlorosilane. Two condensation products of 1,4-bis-(dimethylchlorosilane) benzene were prepared, and 1,3-(methylphenylchlor) disiloxane was isolated.

Mechanical Breakdown Rate in High Polymers

By N. K. Baramboim, "Zhurnal Frizicheskoi Khimii," Vol. 32, 6:1248-1251, June 1958.

The temperature dependence of the rate of mechanical breakdown of polymers, other conditions being constant, was found to be determined by their physical state. The temperature coefficient of the rate is a negative quantity, and for vitreous polymers it is practically zero.

Acrylonitrile & Methyl-Mehtacrylate Copolymers

By G. S. Kolesnikov, L. S. Fedorova, B. L. Tselline, & N. V. Klimentova, "Izvestiia Akademii Nauk USSR, Otdelenie Khimicheskikh Nauk," 7:886-890, July 1958.

An investigation of the influence of the proportion of monomers in the initial mixture on the composition of copolymers at high degrees of conversion, and of the dependence of some polymer properties on polymer composition. Copolymers of acrylonitrile and methyl methacrylate were prepared by the emulsion method at high degrees of conversion, and their composition was determined. Minimum values of characteristic viscosity (on the one end) and of temperatures of transition into a highly elastic state (on the other end) were found to answer to copolymers of different compositions. As regards

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stability, copolymers of methyl methacrylate with acrylonitrile, containing up to 30 mol. percent acrylonitrile, are similar to polymethyl methacrylate.

Elementary Reactions of Methylacrylate Polymerization

By Z. A. Sinitsyna & Kh. S. Bagdasaryan, "Zhurnal Fizicheskoi Khimii," Vol. 32, 6:1319-1327, June 1958.

The initial rate of polymerization of methylacrylate under the action of dinitrilazodiisobutyric acid has been investigated, and the length of the molecular chains formed was measured. Determination was carried out of the mean life of kinetic chains by the rotating segment, and of the rate of initiation by the diphenylpicrylhydrazyl methods. The following values were obtained for the kinetic constants:

$$(k_p/k_o^{\frac{1}{2}})_{50°} = 0.535;$$
$$E_p - \tfrac{1}{2}E_0 = 4.7 \text{ k cal/mole};$$
$$(k_p)_{50°} = 1{,}000 \text{ 1/mole sec.};$$
$$(k_o)_{50°} = 3.55 \times 10^6 \text{ 1/mole sec.}$$

Preparing Methylisobutylketone

By B. A. Bolomov, B. I. Dolzov, K. P. Katkova, & I. S. Ivanova, "Zhurnal Prikladnoi Khimii," Vol. 31, 6:903-910, July 1958.

Acetone, in mixture with hydrogen or isopropyl alcohol and passed over Cu-activated catalyst, may be converted into methylisobutylketone or diisobutylketone. The best conditions for the preparation of methylisobutylketone are at a temperature of 300°C and a volumetric rate between 500 and 1000; at these conditions, the yield is 65-70 percent of acetone reacted per cycle. Under these conditions, formation of diisobutlketone and of other higher ketones also takes place at a total yield of 10-15 percent of acetone. Unreacted acetone may be recycled for processing, in a 1:1 mixture with hydrogen or a 2:1 mixture with isopropyl alcohol. The maximum quantity of water in isopropyl alcohol should not exceed 13 percent if it is not to lower the methylisobutylketone yield.

Preparation of Diallylphthalate

By J. A. Weigner, V. Kudlachek, J. Baca, & S. Havel, "Chemicky Prumysl," Vol. 8, 7:339-343, July 1958.

A method is described for preparing diallylphthalate with equimolar quantities of allyl alcohol and phthalic anhydride, 0.5% of sulphuric acid (acting as catalyst), and xylene as azeotropic entrainer; yields obtained were up to 81% of theoretical. Latex-FN and p-toluene sulphonic acid are not suitable as catalysts. When xylene is replaced by toluene or benzene, much longer reaction time was necessary. A water-white product was obtained only by treating it with NaOH solution, followed by distillation under reduced pressure; neither the use of a decolorizing agent nor repeated distillation resulted in the formation of a water-white product.

Protective Action of Varnish Coatings

By V. A. Kargin, M. I. Kariakina, & Z. J. Berestneva, "Doklady Akademii Nauk USSR," Vol. 120, 5:1065-1067, 1958.

The effect of diffusion by aggressive substances through varnish coatings was studied electrochemically by method of anodic or cathodic polarization at a wide potential interval; the method permits to estimate the protective characteristics of film coatings. Using platinum at the cathode and varnish coated iron at the anode, the amount and rate of corrosion by a 0.01N solution of soda were measured and compared with those at an unprotected iron anode. Corrosion is a conversion of the metal into various chemical substances; their formation at the metal-film contact layer signifies the appearance of a new "phase." While the diffusion characteristics are a basic factor determining the protective properties of varnish and lacquer coatings, adhesion of film to metal was found to play a vital role: the high adhesiveness of some coatings inhibits the formation of the new "phase" at the film-metal contact layer.

Volatility of Plasticizers

By Sh. L. Lel'chuk & V. I. Seblic, "Zhurnal Prikladnoi Khimii," Vol. 31, 6:887-891, June 1958.

The paper is the fourth in a series dealing with the influence of plasticizers on the properties of polyvinylchloride (PVC). In order to achieve high

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effectiveness in respect to PVC, plasticizer should possibly be of aliphatic structure; at the same time, however, its compatibility with the polymer deserves attention. Compatibility of plasticizer to polymer was determined by a number of methods: a) By studying change in specific viscosity of solvent with changing concentration of PVC; b) By determining the temperature of PVC dissolving in the plasticizer (this method is said to be less suitable); c) By determining the solvent ability of plasticizer, through separating PVC by a non-solvent such as methyl alcohol; d) By determining the percentage of swelling of PVC in plasticizer at elevated temperatures (90°C). The following conclusions were derived from the thus obtained data: 1) Plasticizers of aliphatic structure, such as esters of dialkyls and aliphatic carbonic acids, which exhibit highest effectiveness with respect to PVC, are less compatible with the latter than plasticizers containing aromatic groups; this is also borne out by practical experience; 2) The compatibility of plasticizer with PVC falls off with the prolongating carbohydrate part of the former; 3) Increasing polarity of plasticizer means higher compatibility but lower effectiveness of plasticizer with respect to PVC. The values of compatibility and volatility, obtained for a number of plasticizers, were tabulated.

Preparation of Styrene Copolymers

By Ia. A. Drinberg, B. M. Funvyler, & A. M. Frost, "Zhurnal Prikladnoi Khimii," Vol. 31, 7:1080-1086, July 1958.

The copolymerization reaction of styrene with methacrylic acid proceeds through an induction phase whose duration depends on the reaction temperature and on the quantity of methacrylic acid in the starting mixture. At 70 °C, a gradual increase in the copolymer acid numbers is observed; at 100 °C, acid numbers observe an increase and drop after reaching a certain limit. The authors prepared lacquers and subjected them to comparative testing with pure polystyrene lacquers of corresponding concentration; the test lacquer had a twelve-percent concentration in toluene, with 20 percent (by weight of copolymer) tricresylphosphate added as plasticizer. On basis of the data obtained and tabulated, coatings based on the copolymer of styrene with methacrylic acid possess good adhesion to steel, and retain the positive characteristics of polystyrene films such as hardness, resistance to water and to 3-percent NaCl solution. It is sufficient to introduce in the copolymer one percent of methacrylic acid.

Preparation of Thermo-Stable Ethyl Cellulose

By S. A. Glukman, O. G. Efremova, I. K. Kosyreva, & A. I. Somova, "Zhurnal Prikladnoi Khimii," Vol. 31, 7:1087-1091, July 1958.

Experimental work indicated that the following conditions must be met in order to obtain thermo-stable ethyl cellulose: a) the low-molecular and oxidized carboxyl-containing decomposition products must be removed from cellulose; b) during thermo-processing of ethyl cellulose, the carboxyl groups must be neutralized; alternately, the compounds which promote the formation of such groups, must be eliminated. Two methods are suggested to carry out these requirements: 1) the non-acidized product is washed with a boiling acetone-water mixture (ratio 2:1), and subsequently stabilized with a NaOH solution; 2) the non-acidized product is treated with boiling water, acidized without stabilizing, and again treated with boiling water. The resulting product possesses a high thermal stability: it withstands temperatures of 130 °C for fifteen or more hours.

Hydrolysis of Some Dialkylimethoxysilanes

By S. Crzczonowics & Z. Lasocki, "Roczniki Chemii," 32:155-157, 1958.

A study of the relationship between the alkyl group attached to silicon in dialkylmethoxysilanes and the rate of their hydrolysis was undertaken. The authors established that the rate decreases gradually as the sixe of the alkyl substituents is increased. A similar relationship is found to exist between the length of an w,w'-dimethoxypolysiloxane chain and the rate of hydrolysis of the end-blocking methoxy groups. Two series of polymers have been examined: dimethylpolysiloxanes and methylethylpolysiloxanes.

Several new dialkylmethoxysilanes and dialkylsilanediols were prepared, and their physical and analytical data ascertained. The work was carried out at the Department of Organic Technology, Institute of Technology, Lodz (Poland).

High-Pressure Polymerization of Methyl Methacrylate

By E.V. Melekhina & E.V. Kuvshinskii, "Zhurnal Fizicheskoi Khimii," Vol. 32, 5:1016-1022, 1958.

The kinetics of methyl methacrylate polymerization was studies at pressures up to 4,500 kg/cm^2. The rate of polymerization and the molecular weight of the resulting compound was found to increase sharply after the polymerization process reached a degree of 10-15 percent. Rate of polymerization rises with increasing pressure. High pressures apparently lead to no new elementary polymerization reactions.

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NEWS

NEWS OF COMPANIES, ASSOCIATIONS
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ITEMS OF GENERAL INTEREST

Plant Maintenance & Engineering Conference

The tenth year of the Plant Maintenance & Engineering Conference will feature speakers from 19 states, the District of Columbia and two Canadian provinces. The broad geographical distribution will be matched by the diversity of industries from which the speakers are drawn.

The conference will take place during the first three days of the Plant Maintenance & Engineering Show at the Public Auditorium, Cleveland, Jan. 26-29. The show is one of the three largest annual industrial expositions.

Both events are devoted to the upkeep of the nation's factories. Almost 400 companies will demonstrate equipment, services and products.

Almost one-third of this year's topics are new to the program. Ten industries will get special attention. They include nuclear products, abrasive products, metal working and fabricating, assembly plants, chemical, electrical manufacturing, petroleum processing, pulp and paper, foundries, and research and development laboratories. Twenty of the sessions will consider general problems affecting all plants. Among the more urgent problems to be considered this year is the matter of air and water pollution.

L. C. Morrow, consulting editor, "Factory Management & Maintenance," New York, is general chairman of the conference.

Advance registration cards, conference and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

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New Reichhold Affiliate

Reichhold Chemicals, Inc. recently announced plans to establish jointly with prominent Hong Kong industrialists a Hong Kong affiliate for the manufacture of the company's entire line of industrial synthetic resins. The new company will be known as Reichhold Chemicals (Hong Kong), Ltd.

Plans are under way to build a two story plant in the industrial section of Hong Kong which will be ready for production by the spring of 1959. Products of the plant will be available for use in the paint, paper, textile, printing ink, woodworking and polyester industries.

Beside its production facilities, the building will be designed to include offices, laboratory and tankage space. It will occupy a property in the neighborhood of the Hong Kong airport. Specifications for the plant's layout and equipment are being handled by Reichhold engineering staffs at White Plains and South San Francisco.

•

Standardization Seminar

Dr. John Gaillard, consultant on industrial standardization, will hold his next five-day seminar on this subject in New York City, from January 26 through 30, 1959. His seminars are intended to assist top management in establishing the administrative setup and procedure for most effective handling of standardization work in the individual company, and in training staff men in the functions of the standards engineer, including the art of writing specifications. So far, 382 men representing 213 organizations in the U. S. and four other countries have attended.

For details and registration, write to Dr. John Gaillard at his new address: 135 Old Palisade Road, Fort Lee, New Jersey.

•

Tenth Anniversary of Aerosol Division

The 45th Annual Meeting of the Chemical Specialties Manufacturers Association, Inc. was held on December 8-10 in New York City. The theme of the meeting was, "After you spend money making the product, will your label permit you to sell it?"

The program featured the 10th anniversary of the Aerosol Division. The aerosol industry with its 1957 production of 390 million units, at a retail value of about $390 million, estimates that 1958 production will vary from 400 to 500 million units. By 1965, it hopes to attain a billion packages per year output.

In 1957, pressure packagers used 43,000 tons of liquefied fluorinated hydrocarbons. The refrigeration industry's annual requirement is 31,000 tons.

To meet the consumer demand for aerosol products, various pressure packagers used one and one-half million gallons of ethyl alcohol, 750,000 lbs. of synthetic resins, and 54,000 tons of steel.

COIL-PROCESSING PLANT: Tin plate coils are automatically inspected and cut into sheets at high speeds by this heavy equipment in American Can Company's new Hillside, N. J. coil-processing plant. First such plant in the East and one of several opened around the nation as part of a $32,000,000 expansion program, the new unit will supply tin plate sheets for the container firm's factories in the metropolitan area. Substantial economies achieved through Canco's coil-processing program will mean an aggregate saving to can-using customers of over $9,000,000.

NEWS

Stride Buys Paint Concern

Theodore B. Fobes, president of Burgess, Fobes Co., announced the sale of the hundred year old paint manufacturing business to Mr. Richard J. Stride of Saco, Maine.

R. J. Stride

Mr. Fobes said that the effective date of the transaction was January 1, 1959. The name of the concern has been changed to Burgess Fobes Paint Co. Headquarters for the manufacturing and sales departments will remain at 106 Commercial Street, Portland.

The new president, Mr. Stride, is also president of Biddeford & Saco Bus Lines, Inc. He graduated from Duke University and Duke University Law School and is a member of the Massachusetts Bar Association.

Mr. Stride stated that he did not anticipate any change in the personnel of the company.

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Pittsburgh Fumaric Plant

A new basic supplier of fumaric acid entered the market when Pittsburgh Coke & Chemical Company placed a new plant on stream. The company now becomes one of three producers in the United States.

The new facility will increase availability of the high quality fumaric required by the rapidly growing polyester plastics industry, according to W. K. Menke, vice president—chemical divisions. He noted that this new addition to Pittsburgh's line of chemical intermediates (which now includes phthalic and maleic anhydride) will increase the company's ability to service the plastics industry.

New techniques developed by the company's Research and Development Department made feasible the production of fumaric acid through utilization of integrated materials from its phthalic anhydride operation.

Present national production of fumaric acid is estimated to be 10 million pounds, Mr. Menke said, noting that Pittsburgh Coke & Chemical is now the second company in the United States to produce this chemical from its own basic raw materials.

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Iddings, Scott Merge

Announcement has been made by Carl Iddings, president of Iddings Paint Company, Inc., of the merger with Scott Manufacturing Co. of Chicago.

The merger will expand the Iddings operations and add to the present offices and plants in Long Island City, New York and Los Angeles, California.

The Chicago operation will continue under the management of L. S. Donaldson. It will be known as the Scott Manufacturing Division, Iddings Paint Company, Inc.

No changes are planned in the personnel, distribution, service or products of the Scott Manufacturing Division.

•

Corporation Formed

The formation of a new corporation, United Ultramarine & Chemical Co., Inc. has been announced.

With executive offices in New York City, and sales agents and warehousing throughout the United States and Canada, it will market a full range of Ultramarine Blue pigments and allied chemicals manufactured by the parent company, Vereinigte Ultramarine Fabriken A. G. of Cologne, Germany.

COLOR CHIPS DEMONSTRATION: Color chips used extensively by W. P. Fuller & Co. are still unknown in Belgium according to Belgian paint manufacturer Julien Peten (center). Giving the Belgian small business study team member a demonstration of their use above is A. L. Janssens (left), manager of the Fuller service store in San Francisco, and H. P. Shobar, service stores' marketing manager for W. P. Fuller & Co. Mr. Peten is one of five Belgian businessmen visiting American industrial plants under the sponsorship of the Belgian Productivity Center of Brussels.

WALL COATING: A durable glaze, simulating ceramic tile, can now be applied to cinderblock school halls, bathrooms and kitchens with a coating containing Bakelite epoxy resin. This type of wall coating is easy to apply and costs considerably less than tile, according to the manufacturer, Universal Chemical Corp. Coating said to produce a hard, tough finish which is stain-resistant, washable and nonfading.

NEWS

Glycerine Convention Features Alkyd Panel

The Association of American Soap & Glycerine Producers, Inc. will hold its 32nd annual convention at the Waldorf Astoria Hotel, New York, N. Y., on January 20-22.

A feature of the Division Sessions promises to be the Fatty Acid Producers' Council Panel Session scheduled for the afternoon of January 20. Fatty acids and derivatives in special-purpose soaps and detergents will be discussed by a six-man panel of experts. The sales significance of technical advances in products based on fatty sources will be outlined.

The convention's highlight, scheduled for the afternoon of January 22, will be the Glycerine Producers' Association Session. This session is a special invitation symposium for paint and resin people. *Alkyds in Transition* will be the topic discussed. The following seven-man panel will cover tomorrow's alkyd markets, alkyd competition, copolymers, water dispersible alkyds, the research needs that lie ahead. . .all key factors for glycerine sales in this field:

Herman J. Lanson, U. S. Vehicle & Chemical Co.
"Time of Transition" for Alkyds—Areas to which alkyds must look for future business and growth.
Edward G. Bobalek, Case Institute of Technology.
Effect on Chemical Constitution on the Properties of Alkyds.
J. N. Bulter, Monsanto Chemical Co.
Amino-Alkyds—Their Future Depends on You.
T. F. Mika, Shell Development Co.
Epoxy-Alkyd Combinations and their Future Possibilities.
James R. Eiszner, Amoco Chemicals Corp.
Trimellitic Anhydride Alkyds—Today & Tommorrow.
Marvin W. Formo, Archer-Daniels-Midland Co.
Water-Thinned Resins — Where They Stand.
J. S. Long, Paint Research Institute.
Research Needs That Lie Ahead.

Invitations to attend this panel discussion are available from: The Association of American Soap & Glycerine Producers, Inc., 295 Madison Ave., New York 17, N. Y., or any glycerine producer.

Reichhold Plant Completed

Reichhold Chemicals, Inc. has announced the completion of manufacturing facilities at its plant in Kansas City, Kan. for the manufacture of polyvinyl acetate emulsions.

The plant is equipped to produce 15,000,000 pounds of polyvinyl acetate emulsions a year, which makes it the largest unit of its kind in the Plains State region.

The Kansas City plant, in addition to its new operations, will continue in the manufacture of a wide range of synthetic resins. By April of 1959, the productive facilities will be broadened with the completion of a new RCI $500,000 formaldehyde producing plant now being built on the same site.

•

"Carbon Fog" Mystery

Recently, homes in a heavy industrial area of Chicago were reported to be stained with black, gray, or reddish-brown streaks.

Tests were conducted and the conclusions indicated that the houses would have to be scraped and repainted.

However, a heavy rainfall intervened and when inspection was resumed, the paint was clean.

An opinion of some of the Chicago Paint, Varnish & Lacquer Association's experts was that the heavy fog (which had been present for a time), the smoke in the area, and probably an error in steel processing, without wind to move air, resulted in the staining.

Rutgers Offers Course In Paint Technology

The Rutgers University adult center in Newark will present, in its spring term beginning February 2, 1959, its course in "Laboratory Techniques in Paint Technology."

Beside covering the latest laboratory instruments and their use in analyzing and evaluating pigments, vehicles, paint dispersions, and paint films, the course familiarizes the student with a spectrophotometer, the electron microscope, and the X-Ray diffraction apparatus.

The 16 lectures, which are given on Monday evenings from 8:10 to 9:50 beginning February 2, are alternated with field trips to such laboratories as the DuPont Research Center, Newark; Beckman Instrument Corp., Mountainside; Heyden-Newport, Garfield; Shell Chemical Corp., Union; Celanese Corp., Summit; American Cyanamid Corp., Bound Brook; and Gardner Labs, Bethesda, Md.

William Lawrence, technical director of Trade Sales Finishes for the Flood and Conklin Manufacturing Co., Newark, will be the instructor. Mr. Lawrence will also teach in the spring term the Rutgers' "Fundamentals Course in Paint Technology" beginning Wednesday, February 4.

Inquiries about either subject should be directed to the University Extension Division, Rutgers-The State University, Dept. PVP, 601 Broad Street, Newark, N. J.

CLUB PANEL: Production planning panel of the Cleveland Paint & Varnish Production Club. Pictured, left to right, are Robert C. Kempf; Robert A. Began; Allen J. Wandersleben, Moderator; Robert A. Schannen; and Theodore W. Doyle.

NEWS

N. Y. Club Holds Technical Meeting

Fifty members and guests of the technical committee of the New York Paint & Varnish Production Club recently attended its first meeting of the 1958-59 year.

Herb Hillman introduced the new officers of the group:

Chairman - Herbert E. Hillman
Eaglo Paint & Varnish Corp.
Vice-Chairman - Sidney B. Levinson
D. H. Litter Co.
Secretary - Raymond L. Whitney
National Lead Co.

He also introduced five men who were attending these meetings for the first time:

W. J. Allsopp - Titanium Pigment Corp
Alex Engel - Lacquer Corp. of America
Bruce L. Garner - Geigy Industrial Chemical
Bernard S. Karten - D. H. Litter Co.
H. W. Zussman - Geigy Industrial Chemical.

Finally, Mr. Hillman reviewed the overall policy of the technical committee, which at present has a membership of 88 plus 21 collaborators all active on one or more of the 12 sub-committees studying various phases of protective coatings and manufacture.

The following four committees reported on the progress of work:

Sub-Committee #53—*Study of Pigment Dispersion*

John Oates, chairman, stated that they were studying the effect of solvents on flooding and flocculation of tinted whites.

They have dispersed white and various tinting colors in 100% NV alkyds. When these are blended and reground no flooding is observed. However, as soon as any solvent is added, it occurs; the degree of flooding varying with the concentration and aromaticity.

The committee will try to determine the reason for the effects produced by examining drawdowns made on glass under higher magnification.

Sub-Committee #40—*Hiding Power*

Leonard Schaeffer, chairman, described their present technique, which has reduced errors due to variation in film application.

They developed the maximum concentration for each color to achieve maximum opacity. This is reduced with different concentrations of clear vehicle to produce varying levels of opacity for each color.

The principal problem at present lies in variations between instruments as affected by the color itself. Neutral grays are fine. On the other hand the purer colors are not, particularly with blues.

The problem most likely lies in the use of a single green neutral density filter normally used in reflectance and opacity measurements.

Sub-Committee #68—*Effect of U/V on Lacquers*

Joe Cantor, vice-chairman, stated that the committee will test U/V absorbers dispersed in a nitrocellulose lacquer containing a minimum of plasticizer.

Numerical relationships of efficiency of these absorbers will be determined by measuring the yellowness factor $\frac{(A-B)}{G}$ versus time of exposure at different concentrations. The major problem is an adequate source of uniform U/V light. The mercury quartz arc appears to be best to date.

Sub-Committee #70—*Industrial Engineering in the Paint Industry*

Werner Klugman, chairman, stated that their report on Incentive Systems was almost complete.

At their last meeting they had an interesting interview with a labor attorney. His point of view was that Incentive Systems should be discussed with union management before initiation to prevent the innate distrust of the worker for any system, which might lead to a speed up or possible elimination of his job.

He also stated that management should consider its own efficiency in contributing to such a system by eliminating waiting time, e.g., by speeding up receipt of raw materials.

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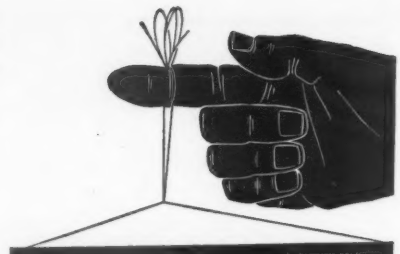
General Mills Center

General Mills has announced that it will break ground next spring on a multi-million dollar Research Center to be built in Golden Valley, west of Minneapolis.



Jan. 19-21. Committee D-1 on Paint, Varnish, Lacquer and Related Products, Deshler-Wallick Hotel, Columbus, Ohio.

Jan. 20-22. 32nd Annual Convention of the Association of American Soap & Glycerine Producers, Inc., Waldorf Astoria Hotel, New York, N. Y.

Feb. 19-20. Annual Divisional Conference of the Protective Coatings Subject Division, Chemical Institute of Canada, Toronto and Montreal, on Respective Dates.

PRODUCTION CLUB MEETINGS

Balitmore, 2nd Friday, Park Plaza Hotel.

Chicago, 1st Monday, Furniture Mart.

C.D.I.C., 2nd Monday.
Cincinnati — Oct., Dec., Mar.,
Cincinnati — Oct., Dec., Mar., May, Hotel Alms.
Dayton — Nov., Feb., April, Suttmilers.
Columbus — Jan., June, Sept., Fort Hayes Hotel.

Cleveland, 3rd Friday, Cleveland Engineering & Scientific Center.

Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.

Detroit, 4th Tuesday, Rackham Building.

Goldern Gate, 3rd Monday, Sabella's Restaurant, San Francisco.

Houston, Monday prior 2nd Tuesday, Rams Club.

Kansas City, 2nd Thursday, Pickwick Hotel.

Los Angeles, 2nd Wednesday, Scully's Cafe.

Louisville, 3rd Wednesday, Seelbach Hotel.

Montreal, 1st Wednesday, Queen's Htel.

New England, 3rd Thursday, University Club, Boston.

New York, 1st Thirsday, Brass Rail, 100 Park Ave.

Northwestern, 1st Friday, St. Paul Town and Country Club.

Pacific Northwest, 3rd Thursday, Washington Athletic Club, Seattle, Wash.

Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.

Pittsburg, 1st Monday, Gateway Plaza, Bldg. 2.

Rocky Mountain, 2nd Monday, Republican Club, Denver, Colo.

St. Louis, 3rd Tuesday, Kings-Way Hotel.

Southern, Annual Meetings Only.

Toronto, 3rd Monday, Oak Room, Union Station.

Western New York, 1st Monday, 40-8 Club Buffalo.

NEWS

BRI Conference on Field Applied Paints

The Building Research Institute Conference on field applied paints and coatings was held on December 3 and 4 in Washington, D. C.

Subjects discussed included: Paints and coatings for the interior and exterior of buildings; special paints and coatings for industrial requirements; color with paints and coatings, the economics of paints and coatings in construction and maintenance; the future of paints and coatings; and methods of application and surface preparation.

The following is a summary of some of the conclusions reached in these discussions:

The conference stressed the importance of good communication among paint manufacturers, paint dealers, painting contractors, maintenance supervisors, and builders. Good communication is necessary to avoid confusion; the user wants a simplified generalization on all types of paint and how they should or should not be used.

What the user wants—

- Products which are easier to use
- Ease of surface preparation
- Better products such as blister-resistant paints
- Painting guide book (glossary of terms)
- Economics of paints (cost per square foot)

What the architect wants—

- Paints that can be applied in all weather conditions
- Paints which will be satisfactory for all surfaces
- Paints must be foolproof since the number of skilled craftsman is expected to decline

•

Information Service

The Cheminform Institute has just started a new chemical information service. It is located in the Coliseum Towers, New York City. A file of trademarks in the chemical and allied fields is now available for immediate use.

A unique feature of this file is that it includes registered, unregistered, common, trivial, foreign, scientific and technological names in every type of chemical and chemical using industry. In many cases, the chemical composition or active ingredients, use of the product and name of the manufacturer are given. It is international in scope, serving the most important foreign countries in addition to the United States.

IC COLOR CENTER: Using special lighting and a magnetic blackboard, Color Center Director F.L. Wurzburg, Jr., (right) discusses color variations of a printer's proof with (from left) Robert Cleary, Alfred Di Bernardo, and Dudley Head of Interchemical Corporation and Maurice Welt of Crafton Graphic Company, Inc. Switchboard controlling Center's six-stage illumination system can be seen below blackboard. The center, located at the Central Research Laboratories in New York City, provides headquarters for basic research, consultation, and information in the field of color.

OUTLOOK

(*From page 30*)

acid is in poor supply and to some extent limits the amount of naphthenate drier available. Nevertheless, there is sufficient naphthenate driers to meet current demands. This demand is, if anything, decreasing, due to the inroads of water-thinnable paints which use little or no drier, and the fact that other acids are being used to a greater extent. These include octoates, tallates and oleate-linoleate driers. The relatively new oleate-linoleate driers show great promise because of their excellent stability, and low-odor, making them ideal for odorless paints. They are readily available and their raw material position is excellent. Zirconium type driers which are said to also improve film properties of paints are gaining interest in the paint field.

The supply situation of fungicides and preservatives is good. The demand for these products is increasing due to the steady growth of water-thinned paints and the increasing use of lead and zinc-free paints, which are prone to mildew attack. Phenyl mercury compounds are used extensively as a preservative fungicide in both solvent and latex emulsion paints.

Additives are becoming important materials for the paint formulator. The formulator has learned to use them to impart certain desirable characteristic to coatings. These characteristics may be improved viscosity, gloss, levelling, brushability, etc., and may be achieved at lower cost by addition of the proper additive.

The upsurge of water-thinned paints has spurred the use of water-thickeners, sequestering agents, freeze-thaw stabilizers, anti-foam agents, and pigment dispersants. They have also aroused interest in universal grinding liquids—special vehicles into which different colors may be ground and dispersed and which may be then used for tinting both water and solvent based paints.

The above developments help to emphasize that the field of paint additives, driers, and fungicides is becoming an important factor in paint technology.

PERSONNEL CHANGES

AMERICAN CYANAMID

M. H. Mettee has become sales manager of the dyes department, it has been announced.

Mr. Mettee will have overall responsibility for the marketing of all dye products of the company. His office will be in the department's headquarters at Bound Brook, N. J.

Mr. Mettee, who joined the firm in 1932, has served the company in several sales managerial capacities, primarily in the dyes marketing field. Most recently, he has been manager of the intermediates department.

Dr. Leonard G. Tompkins has been named technical manager for the petrochemicals department of the Organic Chemicals Division, it has also been announced.

He succeeds **Dr. J. C. Pullman** who has been appointed assistant to the division's commercial development manager.

Dr. Tompkins is a graduate of Stetson University in DeLand, Florida and of Purdue University. He taught at both the University of Idaho and at Stetson University for six years prior to joining the Research Laboratories in Stamford, Conn. in 1953.

HEYDEN NEWPORT

Harold E. Rose has been appointed vice president in charge of production, it has been announced.

Mr. Rose will succeed **H. L. Marter,** who retired November 1.

Mr. Rose, who joined the firm in 1940, has been superintendent of the division's Oakdale, Fla. plant and has supervised operations at the company's other producing facilities as assistant vice president of the division.

Mr. Rose received a B.S. degree in Mechanical Engineering from Texas A & M in 1938.

HOLLAND

Dr. Arzy R. Gray has been appointed director of research and development for the firm, a subsidiary of Chemetron Corporation, it has been announced.

A. R. Gray

Dr. Gray will make his headquarters at the company's plant in Holland, Mich., where he will head an expanded program of research, product application, and product development in organic color pigments, dispersions, intermediates and chemicals.

For the past three years Dr. Gray has been professor of chemistry at Southwestern College, Winfield, Kas., from which he was graduated with a BA degree in chemistry in 1929. He also holds M. S. and Ph. D. degrees in organic and analytical chemistry and bacteriology from the University of Illinois.

T. A. McCormack has been named eastern technical sales representative, it has also been announced.

Mr. McCormack will be located at the offices of the American Mineral Spirits Company, Murray Hill, N. J., and will coordinate technical sales and customer service activities with the William McGill Company of Baltimore, Md., H. B. Lewis Company of Boston, and O. L. West Company of Wynnewood, Pa., all distributors of the firm's line of organic pigments.

Mr. McCormack has been in technical sales and customer service work since 1954. He previously spent three years as manager of the pigment division of United Wallpaper, Inc., Aurora, Ill., and 20 years as a member of the technical service staff of the General Dyestuff Corporation sales division of Ceneral Aniline and Film Corp., New York.

ADELPHI

Fred Gartenlaub has been named metropolitan service supervisor of the firm, located in Ozone Park, N. Y., it has been announced.

Mr. Gartenlaub formerly served as technical director of trade sales.

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Write for samples and complete information.

SPECIFICATIONS

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NON-VOLATILE	30% ±1%
COLOR	6 Maximum
ACID NO.	10 Maximum (on solids)
WEIGHT per gal.	7.3 lbs.
TYPE	Pure drying oil alkyd

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KOPPERS

Hubert G. Guy has been named technical director of coatings in the marketing department of the Plastics Division, it has been announced.

H. G. Guy

Mr. Guy, who joined the firm in 1941, had previously held the position of manager of the Application Laboratory.

In his new position, he will be in charge of all development work connected with materials for coatings in the paint, paper and textile industries.

MINNESOTA MINING

Dr. Carl E. Barnes has been elected vice president for research, it has been announced.

Dr. Barnes will be responsible for all major research programs and policies while **Lloyd A. Hatch,** vice president for new product development, will continue to coordinate commercialization programs for new products.

The company also announced that **Dr. John W. Copenhaver** has been named director of central research, the post formerly held by Dr. Barnes.

Dr. Barnes joined the firm in 1954 as central research director after serving as director of research for Arnold, Hoffman & Co., from 1950 to 1953, and as associate director of research for General Aniline & Film Corp. from 1942 to 1950.

Dr. Copenhaver was associate director of research for the M. W. Kellogg Co. from 1949 until April, 1957, when Jersey City, N. J., firm's "Kel-F" chemical manufacturing business was acquired by the company. Shortly after the acquisition, Dr. Copenhaver became an associate director of the central research department.

EMERY

Albert A. Nelson has been named commercial research manager, it has been announced.

A. A. Nelson

He will conduct market studies, sales analysis, and profit and pricing studies.

Before joining the firm, Mr. Nelson conducted sales research for the Gibson Art Company. He also has been a buyer for the Procter & Gamble Company.

A graduate of the University of Cincinnati College of Business Administration, he also holds a master's degree from Xavier University.

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REICHHOLD

W. Arthur Weismann has been advanced to the position of sales promotion manager, it has been announced.

W. A. Weismann

Mr. Weismann, who for the past two years has been regional sales manager of the company's surface coating resins department, will be engaged in promoting the sales of products.

He will work from the White Plains headquarters, where he will be in close touch with the company's product sales managers.

Before joining Reichhold, Mr. Weismann sold resins and vegetable oils for Archer-Daniels-Midland Co.

NATIONAL CAN

The following changes have been announced:

Fred B. McNamara has been promoted to Central Division sales manager. Mr. McNamara, who joined the firm 23 years ago, most recently was sanitary can sales manager for the former Central-Atlantic Division.

R. B. Ganung has been appointed sales manager for the Chicago district. Mr. Ganung, formerly assistant district sales manager of the New York office, has been with the company for 27 years.

C. O. Wood has been named Ohio-Central Indiana district sales manager. Mr. Wood, who has been on the sales staff, will headquarter in Hamilton, Ohio.

Ben F. Batcheler has been appointed sales manager of the Wisconsin- Michigan-Minnesota district. Mr. Batcheler, who has been on the sales staff, will headquarter in Chicago.

S. V. O'Donnell has become assistant to the Central Division sales manager. Mr. O'Donnell, former Chicago district sales manager, is a veteran of 28 years with the organization.

UNION CARBIDE

New appointments for **Clifton D. Crosby** and **Robert H. Hoffman** have been announced.

Mr. Crosby, previously a market analyst in the market research department, has been promoted to assistant manager, sales analysis. In his new position, he will share the responsibilities for planning and developing improved sales analysis procedures.

Mr. Crosby attended Harvard University where he received the degree of A. B. in Economics in 1950, and the degree of Master of Business Administration in 1952.

Mr. Hoffman, formerly a technical representative in the Newark District, has been assigned to the sales analysis department.

In his new position, he will supervise the mechanical reproduction of sales analysis reports.

Mr. Hoffman graduated from LaSalle College in 1946 with a B. A. degree in chemistry.

ATLAS POWDER

Arthur F. Quinlan has been appointed assistant regional manager of the chemicals sales office in Chicago, it has been announced.

Mr. Quinlan joined the firm shortly after receiving his bachelor's degree in chemistry in the company's New York chemical sales office.

GOODYEAR

Richard H. Daly has been named special representative to the Philadelphia office of the Chemical Division, it has been announced.

R. H. Daly

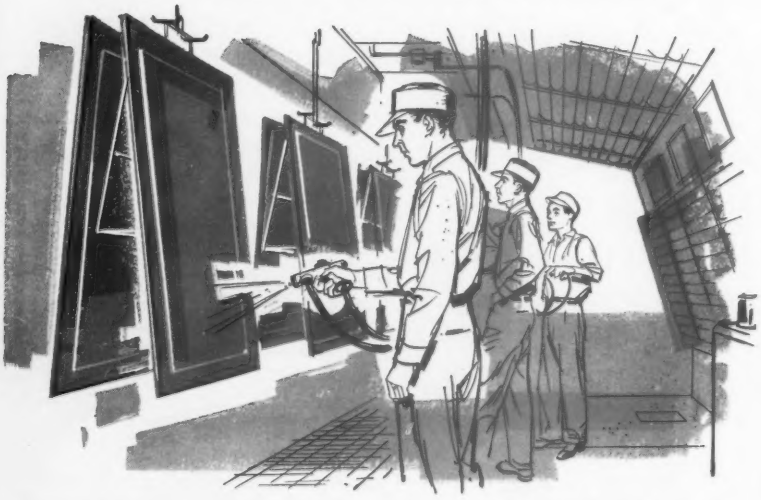
Before going to his new post, Mr. Daly will be assigned to the Chemical Division's Akron offices for a short period of training. In Philadelphia, he will be concerned principally with sales of Pliolite latices and Pliolite S-5 masonry paint resins. His territory will include Southeastern Pennsylvania, Southern New Jersey, Delaware, Maryland and Virginia.

He has worked with latex and its applications in research and development areas for the past eight years.

Mr. Daly is a graduate of St. Anselms College in Manchester, N. H.

Hercules Research Reveals

PE ALKYDS MADE WITH PELARGONIC ...IMPROVE METAL FINISHES



Hercules Powder Company, a leading supplier of pentaerythritol for the protective coatings industry, recently completed a comprehensive study of alkyd-amine automotive and appliance finishes.

Hercules laboratory results show conclusively that PE alkyds made with Emfac 1202 Pelargonic Acid as the fatty acid modifier have definite advantages. Primary improvements include better color, color stability, gloss, and gloss retention. Other advantages are hardness, resistance to dirt pick-up, and alkali resistance.

Since Emfac 1202 Pelargonic acid is competitive in price with other fatty acid modifiers, your PE alkyds can have these superior properties with no increase in cost. Begin your evaluation of PE-pelargonic alkyds today. Trial samples of Emfac 1202 are available on request.

Emery ORGANIC CHEMICAL SALES DEPARTMENT

Emery Industries, Inc., Dept. X-1 Carew Tower, Cincinnati 2, Ohio

West Coast: Vopcolene Div., 5568 E. 61st Street, Los Angeles, Calif.

Export: Carew Tower, Cincinnati 2, Ohio

PITTSBURGH PLATE GLASS

Dr. **Howard L. Gerhart** has been appointed director of research and development for the Paint and Brush Division, it has been announced.

H. L. Gerhart

In his new position, Dr. Gerhart will direct the activities of over 500 company scientists, technicians and engineers engaged in research, development, application, and technical sales service for trade sales paints, industrial and automotive finishes, special coatings and plastics.

Dr. Gerhart, whose headquarters will be at the company's general offices, joined the company in 1937 as a chemist at its Milwaukee, Wis., research unit. He was appointed research director in 1947, when research facilities were located at Milwaukee and remained in that post when operations were transferred to Springdale, Pa., in 1954.

Dr. Gerhart received the degree of Bachelor of Science from Franklin and Marshall College in 1931 and his Ph. D. degree from Northwestern University in 1935.

GLIDDEN

Charles A. MacRonald has been named paint division manager, it has been announced.

In his new position, Mr. MacRonald replaces **Ralph A. Camacho** who has resigned to become president of Pinturas Central Americanas, S. A.,in Guatemala City, Guatemala.

Mr. MacRonald joined Glidden International, a foreign operating subsidiary of the company, in 1956 as a foreign sales representative. Prior to that, he was associated with the foreign office staff of the Office of the American Consulate in Cali, Colombia. He has also been employed by Standard Toch Chemicals, Inc., and was in charge of export sales of trade sales products, industrial finishes and lacquers.

Mr. MacRonald attended the Universidad Javeriana in Bogota, Colombia, and the City College of New York.

SHAWINIGAN RESINS

Richard E. Martin and **John E. McCarthy** have been appointed to the West Coast sales staff, it has been announced.

Mr. McCarthy will be responsible for the San Francisco and Pacific Northwest territory while Mr. Martin will cover the Los Angeles and Southern California area.

Mr. McCarthy, who has been a project engineer for the past three years, joined the firm in 1955. He received a B.S. degree in Chemical Engineering in 1949 from Worcester Polytechnic Institute.

Mr. Martin, who has been a production supervisor for the past two years, joined the company in 1956 after he received a B.A. degree in Chemistry from Princeton University.

ARCHER-DANIELS-MIDLAND

The following changes have been announced:

Thomas L. Daniels, president since 1947, was named chairman of the board.

John H. Daniels, formerly vice president and manager of the formula feed division, was elected president and chief executive officer.

Richard G. Brierley, formerly vice president and manager of the alfalfa division, was named executive vice president.

METALSALTS

Robert O. Weiss, formerly vice president in charge of production, has been named president, and **Frank C. Johnson,** a former sales manager, has been appointed vice president in charge of sales, it has been announced.

Mr. Weiss' association with the firm dates back to 1944 when he undertook the direction of the corporation's technical research program in the mercurial field—which resulted in the development of various new products.

Mr. Johnson has served the company as sales manager for mercury and mercurials during the past 13 years, and has been associated with the industry for 20 years—previously serving on the War Production Board with the responsibility for national allocation of mercury.

In his new position, he will direct the sales of mercury and related mercurial products.

PRUFCOAT LABORATORIES

Russell N. Keppel, formerly director and vice president in charge of marketing for Esso Standard Oil Company, has been named vice president, it has been announced.

Mr. Keppel, who will make his headquarters at the New York City sales office, has exceptionally broad experience in both domestic and overseas marketing. In addition to having been responsible at one time for Esso's 18-state marketing operation, he also had general supervision of all phases of marketing for Standard Vacuum Oil Company in 50 overseas countries.

A law graduate of the University of Buffalo, Mr. Keppel also attended N. Y. U., Columbia and Harvard where he studied business administration and management.

GREAT LAKES CARBON

N. William Muller has been appointed a vice-president and general manager of the firm's research and development department, it has been announced.

Mr. Muller succeeds **Dr. Samuel W. Martin,** who recently died. He will make his headquarters at the general office in Chicago.

In his new post, Mr. Muller will direct research and development activities connected with products manufactured by the company's five divisions, as well as new products in related chemical fields.

FERRO

Jack H. Dollinger has been named president of Ferro Chemical Corporation, a subsidiary of the firm, it has been announced.

Formerly sales manager, Mr. Dollinger has been serving as general manager since Last November. Recently he was made vice president and was appointed to the company's board of directors.

A graduate of Brooklyn College, New York, where he received a B.S. Degree in chemistry, Mr. Dollinger holds a Master of Business Administration Degree from New York University, and has worked in chemical sales for over 13 years.

AMOCO

John W. Pfeiffer has joined the marketing staff, it has been announced.

Mr. Pfeiffer holds a B. S. degree from the University of Warsaw, Poland, and a diploma from the Technological Institute in Freiberg, Germany.

During the past 17 years he has been associated with American Cyanamid, primarily in overseas marketing. Most recently Mr. Pfeiffer has been a product development director for Cyanamid International.

ARMSTRONG

D. Dwight Browning, has been named manager of the paint department at the Research and Development Center, it has been announced.

Mr. Browning replaces **Benjamin F. Adams,** who recently died.

A graduate of Mississippi College, Mr. Browning did graduate work in chemistry at the University of Pittsburgh. During these four years he worked on the Armstrong Fellowship at the Mellon Institute.

He joined the organization as a staff member of the paint department at the Research and Development Center in 1950.

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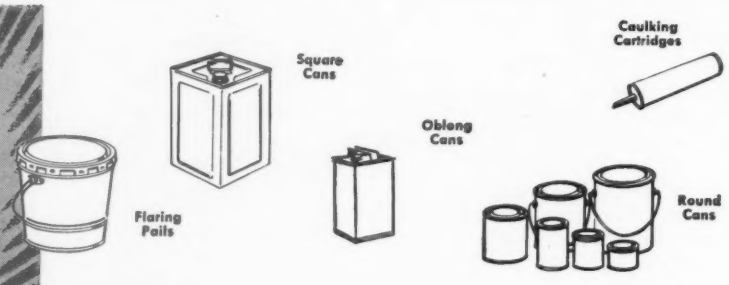

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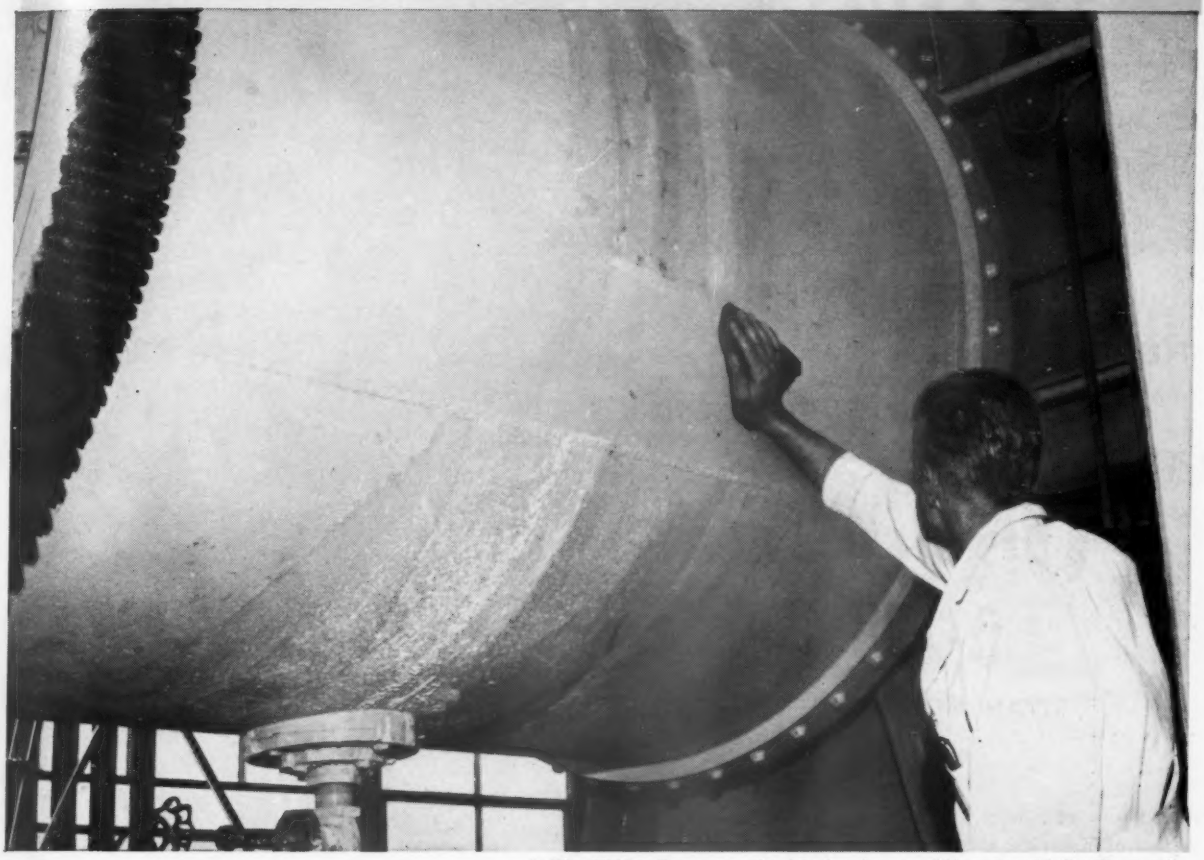

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